SCIENTIFIC AMERICAN

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THE GATLING GUN FOR POLICE PATROL SERVICE.

The latest model of the Gatling gun, shown in the accompanying illustration, has been given the name of the "Police gun," from its admirable adaptation for police or mounted service, for guarding railway trains, banks, or safe deposit institutions, or for use on vessels, yachts or boats. Its weight is but 74 pounds, so that it can be carried if necessary by a single man, or, with all accessories for the field, on a single animal. It has six barrels, and the feed is positive, enabling it to be fired at the rate of 800 shots per minute at all angles of elevation and depression. When set up in the back part of a patrol wagon, and served by two or three men, it is designed to do more effective work in dealing with a mob or in dispersing rioters than could be accomplished by a whole company of infantry. In the patrol wagon is also carried a supply of ammunition, and a tripod on which the gun may be mounted for service out of the wagon.

This latest type of a rapid firing weapon retains the individuality of the Gatling gun, its revolving locks and barrels enabling perfect continuity of loading and firing, and giving it great power of rapid and prolonged action. The locks and barrels all revolving together, and the barrels being discharged one at a time as they rotate, there is absolutely no trouble from heating. The Gatling gun has been subjected to the most severe tests by the government officials, and many guns of this type are now in use in the navy, where it is considered a very powerful weapon for repelling attacks and for general fighting work at close quarters, as, no matter how long the firing is continued, the barrels do not become heated or fouled so as to be unfitted for use, or the firing mechanism deranged.

An electric firing mechanism for the Gatling gun was not long since tested under the direction and inspection of officials of the United States navy department. The electrical apparatus was attached to the barrel of the gun so as to move with it, while it was so disposed of as not to interfere with the elevation or depression of the gun. By the use of the electrical apparatus the gun is fired automatically at a rate of speed, for a piece of ten barrels, of 1,500 discharges per minute and upward. If the electrical apparatus becomes disabled, or its connections are severed, a handle can be connected in a few seconds, by which the gun may operated by hand, as shown in the picture, the ten-barrel gun being capable of discharging 1,200 shots per minute when operated by hand.

Improvements calculated to add to the efficiency of the Gatling gun in every field have for years been the special study of Dr. R. J. Gatling, the inventor of this well known type of machine guns. The manufacture of the gun in its various styles is carried on by the Gatling Gun Company, at Hartford, Conn., U. S. A.

Ancient Ruins in Africa.

At a recent meeting of the Royal Geographical Society, Mr. Theodore Bent read before a large audience a paper on his recent exploration among the Zimbabwe and other ruins. The paper, *Nature* says, was one of great interest. Mr. Bent said that, with his wife and Mr. Robert Swan, he went to Mashonaland primarily to examine the ruins of the Great Zimbabwe. These ruins, so named to distinguish them from the numerous minor Zimbabwes scattered over the country, were situated in south latitude 20° 16′ 30″ and east longitude 31° 10′ 10″, at an elevation of 3,300 feet above the sea level, and formed the capital of a long series of such ruins stretching up the whole length of the west side of the Sabæ River. They covered a vast area of ground, and consisted of the large circular building on a gentle rise with a network of inferior buildings extending into the valley below, and the labyrinthine fortress on the hill, about 400 feet above, naturally protected by huge granite bowlders, and a precipice running round a considerable portion of it. Mr. Bent gave a minute description of the ruins, drawing attention to evidence that their ancient inhabitants must have been given to the grosser forms of native worship. Perhaps the most interesting of their finds in one portion were those in connection with the manufacture of gold. Mr. Bent held that the ruins and the things in them were not in any way connected with any known African race; the objects of art and the special cult were foreign to the country altogether, where the only recognized form of religion was, and had been since the days when the early Portuguese explorers penetrated into it and El Masoudi wrote, that of ancestor worship. It was also obvious that the ruins formed a garrison for the protection of a gold-producing race in remote antiquity. So we must look around for such a race outside the limits of Africa, and it was in Arabia that we found the object of our search. All ancient authorities speak of Arabian gold in terms of extravagant praise. Little, if any, gold came from Arabia itself; and here in Africa gold was produced in large quantities, both from alluvial and quartz, from the remotest ages. A cult practiced in Arabia in early times was also practiced here; hence there was little room for doubt that the builders and workers of the Great Zimbabwe came from the Arabian peninsula. He had no hesitation in assigning this enterprise to Arabian origin, and to a pre-Mohammedan period.

THE GATLING GUN FOR POLICE PATROL SERVICE.

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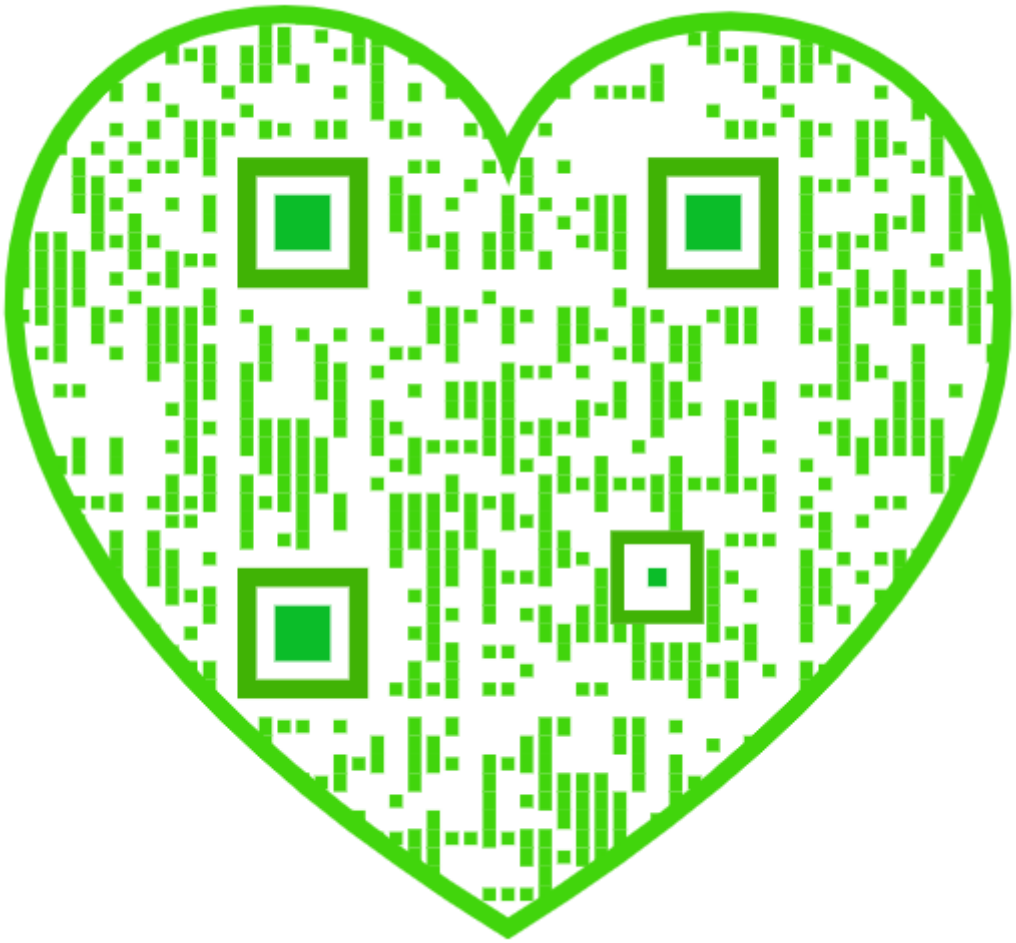

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ACETATE OF SODA WARMERS AND CAUSTIC SODA STEAM BOILERS.

In France acetate of soda has received an extensive application by railroad companies for the purpose of supplying foot warmers. The principle on which it operates and even its true functions are not generally understood.

Sodium acetate is used in the class of foot warmers and similar devices as a factor in the storage of heat. If a brick is warmed in an oven, it represents a source of heat which will supply a greater or less quantity in proportion to the degree of heat which has been imparted to it. A bottle of hot water is of the same category. The weight of the substance heated, its temperature, and its specific heat determine the quantity of heat which is absorbed and will be given out.

In sodium acetate a fourth element enters into the problem. It is a solid crystalline salt, having three molecules of water of crystallization. It possesses the property of dissolving at a boiling temperature in one part by weight of water. If allowed to cool, most of it crystallizes out, leaving about one-third still in solution in the mother liquor. If the apparently dry salt is heated, it liquefies in its water of crystallization, what is practically a fusion of the salt resulting. If kept in this state of fusion in an open vessel, the water gradually evaporates and the salt becomes anhydrous.

The melting of the crystals occurs at a comparatively low temperature. The fusion begins at 136° F., and at 167° F. is complete. As this fusion involves the conversion of a body from the solid into the liquid state, a large number of heat units are absorbed in the process; in other words, a large quantity of heat is rendered latent. This heat is given off during the solidification of the material.

The method for its use consists in packing cases of convenient size and shape for foot warmers and other purposes, as desired, with the salt. These cases should be closed. Placed for a short time in boiling water, the temperature of liquefaction is soon attained, and the salt remains practically at that temperature until melted. The action, though not so definite as regards the point of fusion, is identical with that of the water of melting ice, which cannot pass 32° F. as long as any solid ice remains. The case of melted acetate is now charged with latent as well as sensible heat. In use the salt gradually solidifies, but as it does this maintains its temperature of fusion approximately until it is solid. Then the loss of sensible heat begins and it rapidly cools.

The last described action is again comparable to that of water freezing. As long as liquid water remains in a vessel the temperature, except under special conditions, cannot fall below 32° F. In the case of sodium acetate, the temperature cannot go much below 136° F. until the whole mass is solidified.

When a brick or a metallic slab is used for a foot warmer, the low specific heat of the material renders it ineffective in proportion to its weight. Hot water, on the other hand, is effective, because of its high specific heat, but is too bulky. The sodium acetate seems to avoid both difficulties.

This use of the above salt must not be confounded with the application of caustic soda or sodium hydrate for the generation of steam. In the latter application a direct chemical act of combination is utilized. Water has a strong affinity for sodium hydrate, and unites with it with the production of heat. A parallel case is seen in the uniting of water with quicklime, the heat produced in which operation is familiar to all. The "caustic soda boiler" as it is termed has melted caustic soda surrounding its water chamber. This is necessarily hot when introduced, so that steam is at first generated by the sensible heat. The exhaust steam from the engine is blown into the caustic soda. This, by its combination with the sodium hydrate, generates additional heat. The process goes on until the caustic soda solution becomes so weakened by the water absorbed that it ceases to respond enough to be effective in maintaining the steam pressure in the boiler.

The caustic soda boiler has been successfully tried in the form of locomotives for tramways, tunnels, and in a submarine torpedo boat. It is evident that its advantage in not exhausting the oxygen of the air renders it peculiarly adapted for such purposes. Up to the present time it has been used very little.

Great Bodies of Fresh Water.

Geographers claim that there are twenty-five rivers on the globe which have a total length each of over 1,000 miles. Of these, two, the Mississippi from the source of the Missouri in the Rocky Mountains to the Eads jetties, and the Amazon from the source of the Beni to the isle of Marajo, are over 4,000 miles in length. To be exact, the former is 4,300 and the latter 4,029 miles from the source to the places where their waters are mingled with those of the ocean. Four claim a total length of over 3,000 and under 4,000. They are the Yenisei in Asia, length 3,580; the Kiang, Asia, length 3,900; the Nile, Africa, 3,240; and the Hoang-ho, Asia, which is 3,040 miles. Seven streams on the globe are under 3,000 and over 2,000 miles in length, the Volga in Russia and the Amoor in Asia each being 2,500 miles in length; two are 2,800 miles long, the Mackenzie in British America and the Platte in South America. The Rio Bravo in North America, the Rio Madeira in South America, and the Niger in Africa are each 2,300 miles from end to end. The Arkansas River just comes inside of this 2,000 mile limit. Ten of the great rivers of the world are over 1,000 and under 2,000 miles in length. Three of these are in North America, the Red River 1,520, Ohio 1,480, and the St. Lawrence 1,450. South America has also three in this list, the Rio Negro 1,650, Orinoco 1,600, and the Uruguay 1,100 miles. Asia has three in the same list, the Euphrates 1,900 miles, and the Tigris and Ganges, each of which is about 1,300 miles. In the group of great rivers, the St. Lawrence is the most remarkable. It constitutes by far the largest body of fresh water in the world. If we include the great lakes and tributary rivers, with the St Lawrence system, as they cover about 73,000 square miles, the aggregate represents not less than 9,000 solid miles of water. The unthinkable size of this mass may be better comprehended when we consider the figures of Professor Cyrus C. Dinwidde, who says that it would take over forty years for this entire mass to pour over Niagara at the computed rate of 1,000,000 cubic feet per second.

Indigo.

The chief source of natural indigo is the various species of *Indigofera*, especially *Indigofera tinctoria*, which are cultivated in India, China, and South America. It is also contained in European woad (*Isatis tinctoria*) and a few other plants, the cultivation of which for the production of indigo was a flourishing industry from the ninth to the sixteenth century, and further, one which, thanks to the decrees of the ruling powers in England, France, and Germany, was the cause of delaying the introduction of the "devouring devil's color," as the Indian indigo blue was formerly called. The cultivation of European woad is to-day almost an extinct industry, although up to the commencement of the seventeenth century it was a source of considerable revenue both in France and Germany. The color is not contained in the free state in these plants, but as what is called a glucoside, to which the name of *indican* has been given. In this glucoside the indigo is held in combination with a kind of sugar—glucose—which former undergoes decomposition under certain well defined conditions with the separation of indigo blue. It is the *Indigofera* plants of India, China, and South America, especially the first of these, from which the color is now prepared. The method of its preparation is very simple, although considerable attention is paid to the treatment of the soil previous to the planting of the seeds. Ten to fourteen days suffice for the first appearance of the shoots above the soil, after which they continue to grow rapidly. Shortly before flowering, or about three months after sowing, the plants are cut off close to the ground, and are then ready for extracting the color. After cropping the plants are again allowed to grow until they are sufficiently mature to admit of a second cutting. Occasionally a third and even a fourth crop is made, but each of these contains successively less and less of the indican. The cut plants are at once placed in large stone cisterns or fermenting vats, called "steepers," where they are covered with water, and kept in position by means of boards and heavy stones.

Overeating vs. Overwork.

An abuse that tends to the injury of brain workers is excessive eating. A writer in the *Medical Mirror* recalls to mind several active brain workers who suddenly broke down, and fancied that it was due to brain fatigue, when, as a matter of fact, it was due to overstuffing of their stomachs. The furnace connected with mental machinery became clogged up with ashes and carbon in various shapes and forms, and as a result disease came, and before the cases were fully appreciated, a demoralized condition of the nervous systems was manifested, and they laid the flattering unction to their souls that they had indulged in mental overwork. Hard work, mental or physical, rarely ever kills. If a mild amount of physical exercise be taken, and a judicious amount of food be furnished, the bowels kept open in the proper manner, the surface protected with proper clothing, and the individual cultivates a philosophical nature and absolutely resolves to permit nothing to annoy or fret him, the chances are that he can do an almost unlimited amount of work for an indefinite length of time, bearing in mind always that when weariness comes, he must rest, and not take stimulants and work upon false capital. The tired, worn-out slave should not be scourged to additional labor. Under such stimulus, the slave may do the task, but he soon becomes crippled and unfit for work. The secret of successful work lies in the direction of selecting good, nutritious, digestible food, taken in proper quantities, the adopting of regular methods of work, the rule of resting when pronounced fatigue presents itself, determining absolutely not to permit friction, worry, or fretting to enter into his life, and the cultivation of the Christian graces, charity, patience, and philosophy.

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The Present Sun Spot.

Mr. Christie, the Astronomer Royal, informed the representative of the London *Globe* that this is the largest spot yet photographed at the Greenwich Observatory (where the sun has been regularly and systematically photographed since 1873), and that the greatest attention has been paid to it, with a view to clear up, as far as possible, moot points with regard to the cause, periodicity, and, perhaps, even more particularly, the magnetic disturbance which these spots bring about on this earth. Some excellent photographs have been secured, but, unfortunately, on several days the sun was obscured, and until photographs are received from India or Mauritius the investigation cannot be regarded as complete. However, the information which Mr. Christie has obtained is of the greatest interest and value. In the first place, the spot is found to be composed of two nuclei, very black, surrounded, as usual, by a penumbra, or fringe, and with several smaller nuclei connected with it. Occupying as it does an area of about $\frac{1}{850}$ of the face of the sun as we see it, the "spot"—still to speak of it in the singular number—is plainly shown on the negatives taken at the observatory; photographic plates ten inches square being used, and the solar disk being eight inches in diameter. Without, therefore, the aid of a magnifying glass the unusual size and importance of the spot are at once evident. But it is when the negative is placed under the microscope and accurately measured that the details of its size become more striking, for it is found that, while its greatest length is about 100,000 miles, and its greatest breadth 60,000 miles, the whole group extends over 150,000 miles.

Asked as to what was the cause of these spots, Mr. Christie said that there had been several theories framed to account for the phenomenon, but none that were entirely satisfactory. There were those, for instance, of Faye, Secchi, and Lockyer. The theory of the last named was that the spots are caused by a bombardment of meteoric matter falling into the sun, and causing a great "splash." The nucleus, as the dark part is called, is cold, and is at a lower level than the general surface of the sun; while around the spot are generally seen what are called *faculæ*, part of the sun's surface which are raised up. Often by means of the spectroscope can be traced moving masses of molten matter surging round and over the nucleus. The apparent movement of the spot across the face of the sun is, of course, the movement of the sun itself carrying the so-called spot with it. On these points Mr. Christie was careful to state that all is conjecture; and he pointed out, as an objection to Mr. Lockyer's theory, that while the spots never appear far from the sun's center, the nearer the spot is to the solar equator the faster it appears to move; a spot at the extreme limit from the equator taking two days longer to complete the circuit than one near to it. What he was able to speak more positively upon from the records at the observatory was the characteristics of the spots as they have been observed. In this connection a very valuable series of diagrams have been prepared by Mr. Ellis, both from the observations since 1873 and from the records prior to that year, showing not only that the magnetic disturbances have been coincident with the appearance of the spots, but that the intensity of the disturbance has been in exact ratio with the size of the spot. They further show that the "spottiness" of the sun reaches its maximum every eleven years, dying gradually down to its minimum of absolute freedom from spots, and as gradually increasing. There was, for instance, a minimum in 1878 and a maximum at the end of 1882 or the beginning of 1883. Then, again, there was a minimum in 1889, since which year the number and frequency of the spots has been increasing. It is a notable fact that when there are the fewest spots they come near the equator, but when a fresh cycle begins the spots appear in higher latitudes—about 35° or so from the equator, though never appearing at a greater distance than 40°.

These are the solar phenomena in connection with the spots. The terrestrial magnetic phenomena are equally striking, the magnetic storms or disturbances being of great extent—amounting to several degrees in the deviation of the compass. In the present instance, soon after the spot had passed the central meridian, there was a great magnetic disturbance from noon on Saturday to noon on Sunday, and that was accompanied by aurora on Saturday night. During this period both the movement of the needle to the north and its attraction to the earth showed a great disturbance. This has been fixed by the recording instruments at Greenwich, which work in this way. In the point of the magnetized needle is a small mirror, which reflects light upon sensitized paper. Ordinarily, therefore, there is on the paper, which revolves on a drum, a continuous line, which shows that the needle has been quiescent. But when the magnetic disturbance of Saturday set in, instead of a straight line there was recorded a series of zigzag lines, showing that the needle was darting from one side to the other to such an extent as to get off the paper—some four or five inches in width—on both sides, many times, and exactly the same results were found in the register of currents passing through the earth. The matter of interest now, said Mr. Christie, is to discuss what is the connection between the sun spots and these extraordinary magnetic disturbances. There are now three or four marked cases on record of large spots on the sun being coincident with these disturbances on the scale experienced during the past few days; but while there are no cases of a large spot being seen without magnetic disturbances being felt, there are cases in which the latter have been experienced without sun spots being visible. This might be urged as upsetting the theory; but we only see what is going on on one side of the sun, and it is very possible the spot was "on the other side;" so that the absence of a visible spot cannot be held to prove that there is nothing on the sun causing the disturbance.

The Screw Propeller.

BY SAMUEL NOTT, C.E.

In these days of high art in using steam power it is interesting to call to mind the day of small things, within the memory of thousands of people now living. I find a few notes on this subject in an unexpected quarter, namely, in Bishop Heber's travels in India, which he made tediously by sail on the sea, by oar, setting pole, and sail on the rivers, and, on land, by palanquin, horse, and elephant, through sections now long traversed by railroads. His notes are the more interesting, because he was a good man and a keen observer—"a godly gentleman and a great lover of learning," as was said of John Harvard, the founder of Harvard College, by one of his contemporaries. Nothing escaped the keen eye and attention of the bishop. He visited the King of Oude in 1824, and the king talked about steam vessels, speaking particularly of a new way of propelling ships by a spiral wheel at the bottom of the vessel, which an English engineer in his pay had invented; and in a letter dated at Calcutta on December 14, 1825, he says the steamboat long promised from England, the Enterprise, is at length arrived, after a passage of nearly four months. Here we have an account of one of the earliest experiments with the screw propeller, made by an East India king living away up in the interior; and of the first steamer by the Cape of Good Hope to India.

The late John Ericsson, whose remains were not long ago borne to his native Sweden by a United States ship of war, in consideration of his invaluable services in the late war, was the man of all others to persevere in making the screw propeller a power throughout the world. Previous to 1839 Ericsson tried unsuccessfully to introduce it in England, and came to the United States. In 1840 the English woke up, and the propeller came rapidly into use in England. In 1841 the Princeton was built by our own government, and was the first vessel with a screw propeller in this country. The introduction of the propeller was slow for ten or fifteen years, but now for more than fifteen years it has been the only mode of propulsion used on sea-going steam vessels and tug boats. There is no more animating and impressive sight in busy harbors and on busy rivers than to see the lively tug boats darting about, towing the largest ships with ease; and it is hard to realize that even in Boston harbor, for instance, there were no regular tug boats until, mainly through the continued efforts of John Ericsson, the screw propeller came into general use. Truly, "Peace hath her victories, as well as war."—*The Locomotive.*

A Wonderful Star that No Man Has Yet Seen.

The many wonderful discoveries in astronomy recently made by the aid of photography have seemed to leave the older methods of astronomical investigation far in the rear. But just now Mr. S. C. Chandler, of Boston, has made what may be called a discovery by the aid of mathematical methods, recalling the achievement of Leverrier and Adams in the detection of Neptune fifty years ago. There is in the northern sky a star known as Algol, which the sharp-sighted Arabs who discovered its variations in light called the demon star. Every two days twenty hours and forty-nine minutes this star suddenly begins to fade, and continues to grow fainter for three or four hours, at the end of which it has sunk from the second to nearly the fourth magnitude. After remaining thus for a few minutes it begins to brighten, and in the course of three or four hours more regains its former brilliancy. Within the past few years it has been discovered that there is a huge dark body revolving around Algol at a distance of some three million miles, and to this phenomenon the variations in Algol's light are due. At regular intervals this dark companion star comes into the line of sight between Algol and the earth, and thus partially eclipses Algol, cutting off, perhaps, five-sixths of its light.

These stars, Algol and its strange non-luminous comrade, are of great size, Algol itself being more than eleven hundred thousand miles in diameter, while the diameter of the dark body that circles around it is eight hundred and forty thousand miles.

Mr. Chandler, meditating on certain irregularities in the motions of Algol and its companion, suspected that they might be due to the presence of another invisible star in their immediate neighborhood. He carefully compared the observations back to the time of Goodricke, more than a hundred years ago, and pursuing a mathematical method similar to that which resulted in the discovery of Neptune through the effect of its attraction on Uranus, he arrived at the conclusion that such another star must actually exist. According to his conclusion this mysterious body is far more massive than either Algol or its companion, but does not give forth any perceptible light, and it forms a center of attraction around which both of the other stars revolve in a nearly circular orbit, in a period of one hundred and thirty years. Mr. Chandler's theory seems to fit in well with the observed irregularities of Algol. He remarks, moreover, that there are several other stars known to astronomers to be variable which evidently have one or more dark companions like those of Algol.

It is natural to inquire what is the nature of these mysterious dark bodies existing in the neighborhood of bright stars comparable in brilliancy with our own sun, and evidently obeying the same law of gravitation that prevails in our solar system. The primary distinction between a sun and a planet is that the former glows with a brilliant light of its own, while the planet, having been encrusted with a solid and opaque shell, only shines by the reflected light which it receives from its sun. The dark companions of Algol may then be regarded as in the planetary condition, at least so far as the question of luminosity is concerned. But they differ widely from any of the planets of our system in their great size as compared with the sun in whose neighborhood they circle. That companion of Algol, which by its eclipsing effect produces the variation in the light of the star, is not very far inferior in size to its bright comrade, while the greater dark body, whose existence seems to be demonstrated by Mr. Chandler's investigations, greatly exceeds them both in mass. Here, then, if we choose to adopt the idea that this great invisible orb around which Algol revolves is a planet in our sense of the word, we have a world which is the center of motion for the sun that illuminates it. This is going back to the old pre-Copernican idea of the earth as the center of the solar system, having the sun as its satellite. Such a system seems unnatural, if not impossible, because the ordinary laws of the radiation of heat require that a large body, other things being equal, should cool down from the solar to the planetary condition later than a smaller body. But it would seem that in the Algol system, for some reason yet to be discovered, the most massive member of the system has parted with its light and heat far earlier than one of the satellites revolving around it.

If it should prove to be true, as Mr. Chandler suggests, that there are other, and perhaps many other, systems similar to that of Algol, then we shall simply have additional evidence of the great variety that exists in the arrangements of the stellar universe. There really is no reason why we should take our own solar system as an invariable type to which all the other systems throughout space must correspond. It might be suggested that in the case of such a system as that of Algol, all the bodies belonging to it have long since become extinct through the operation of those laws of cosmical evolution which seem to be manifested in the universe at large as well as in our own planetary system, and that through some such cause as a collision one of the minor bodies of the system has again been brought to a luminous condition.

But there is no end of speculation when we try to interpret the wonderful discoveries with which the astronomy of our time is continually surprising the world.—*New York Sun.*

The Magnetic Properties of Oxygen.

Commenting on Prof. Dewar's recent experimental verification of the magnetic properties possessed by liquid oxygen, M. Guillaume points out, in *L'Industrie Electrique*, that if we accept the values found by Edmond Becquerel for the magnetic constant of oxygen, it ought, when in the liquid state, and in a field of medium strength, to possess a magnetic moment per cubic centimeter one-third of that of iron, and a magnetic moment per gramme twice as great as that of iron; so that the strange conclusion is forced upon us that oxygen is the most magnetic of substances. M. Guillaume also points out that liquid oxygen might be made to give a faithful and delicate representation of the distribution of the lines of force in a magnetic field, the liquid being heaped up in the strong places.

MESSRS. ESCHER, WYSS & CO., Zurich, Switzerland, received a first of prize £200, and Messrs. Ganz & Co., Buda-Pesth, Prof. A. Lupton, Leeds, and Mr. J. Sturgeon, Birmingham, England, received second prizes of £150 each, for projects for hydraulic development, prepared last summer, for the commission of the Niagara Falls Power Company. It will be remembered that none of the projects presented were approved and accepted in their entirety by the commission.

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A SPEAKING TUBE AND EARIPHONE.

The accompanying illustrations represent the practical working of an extremely simple improvement in speaking tubes, the mouth piece being provided with an attached ear piece, whereby messages may be more conveniently received and transmitted. This improvement has been patented by Mr. Frederick Schluchtner, of No. 2661 Atlantic Avenue, Brooklyn, N. Y.

One of the pictures shows the improvement in use in the hallway or vestibule of a house, another representing its employment in a factory, where the different floors are thus held in communication with the office. The mouth piece may be of the usual form, but the tube in front of the whistle has an opening at one side, surrounded by a tube leading into an attached flexible tube, at the end of which is an ear cup. The branch tube leading from the side opening, in front of the

SCHLUCHTNER'S SPEAKING TUBE—USE IN A VESTIBULE.

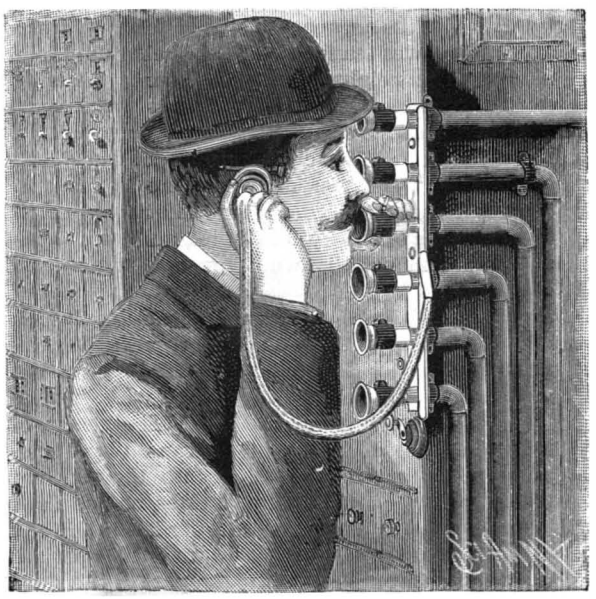
mouth piece, leads backward at a slight angle from the main tube, and the branch tube is also made tapering, the flexible tube being secured to its smaller end. When a person blows into the speaking tube, the air exerts its full force upon the whistle in the usual way, not being diverted into the branch tube. In like manner, in speaking into the tube, the voice is projected forward in the usual way; but one can likewise hear the return message without change of position, the voice in this case being diverted into the branch tube, and thence through the flexible tube to the ear cup, so that a conversation may be carried on without constantly changing the end of the tube from the mouth to the ear, and *vice versa*. A fork supports the ear cup when the mouth piece is not in use.

DETAILS OF SPEAKING TUBE.

This invention has also been patented in Canada, England, France, Belgium, Germany, Austria, Italy, Switzerland, and Spain.

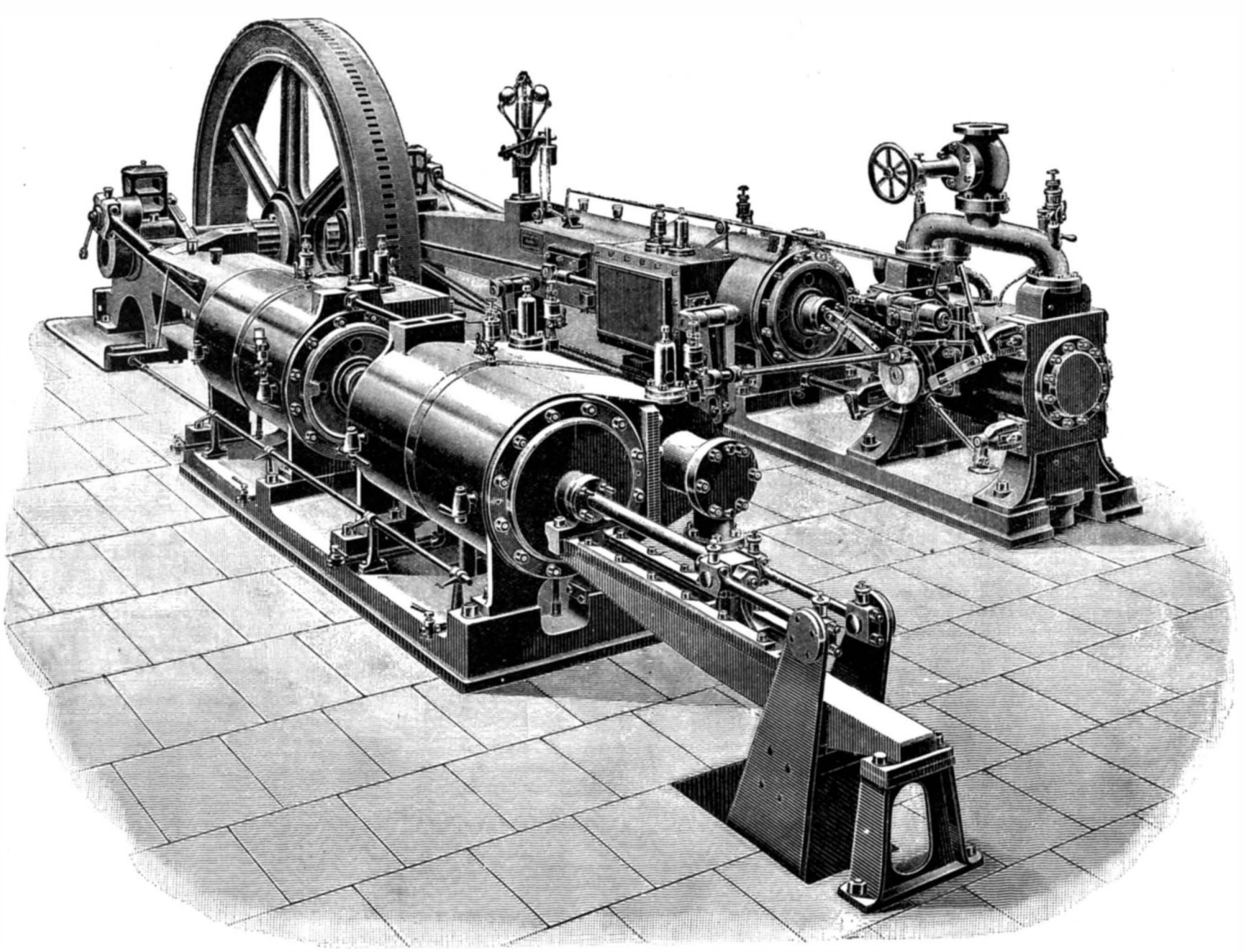
SURFACE CONDENSING TRIPLE EXPANSION MILL ENGINES.

The engines which we illustrate have recently been constructed by Messrs. Hick, Hargreaves & Co., Soho Ironworks, Bolton, for a cotton mill belonging to the Kampenhofs Aktiebolag, Uddevalla, Sweden, to take the place of a pair of Woolf beam engines supplied by the same makers about thirty-five years ago. We are indebted to *Industries* for our engraving and the following particulars: The new engines are horizontal, and of the four-cylinder double-tandem type, the high and one low pressure cylinder working on one crank, and the intermediate and the other low pressure cylinder on the other crank. The high pressure cylinder is fitted with the makers' well known Inglis & Spencer's Corliss gear, the intermediate pressure cylinder with a piston valve, and the two low pressure cylinders with plain slide valves. All the cylinders are jacketed with steam at boiler pressure, and are lagged with composition and felt, cased with planished steel. The steam on its way from the high pressure to the intermediate pressure cylinder, and from the latter to the low pressure cylinders, passes through two receivers, also jacketed with steam at boiler pressure. There are thus six jackets to be drained—viz., four cylinders and two receivers—and the makers, believing that the efficiency of jackets is largely dependent on the thoroughness with which they are kept clear of water and air, have devoted considerable attention to this problem. In the present engines the jackets are drained in series, the combined drain water from all passing into a receiver, which, standing on the engine room floor, and being provided with pressure and water gauges, gives the attendant a much better chance of keeping the jackets efficiently drained than where each jacket has its own trap placed out of sight under the floor, and too often out of mind. The engine is provided with very complete lubricating appliances, including oil pumps for the crank shaft bearings, and with indicating gear for all the cylinders. The power of the engine is transmitted by a steel spur wheel bolted to the fly wheel, but which was not in position at the time the photograph was taken from which our



SCHLUCHTNER'S SPEAKING TUBE—USE IN A MANUFACTORY.

engraving is made. The surface condenser is of the marine type, the water making two passes through Muntz metal tubes fitted in Muntz metal tube plates, and packed with "Hall" joints. To the condenser are attached the air, circulating, feed, and jacket drain



TRIPLE EXPANSION SURFACE CONDENSING MILL ENGINES.

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pumps, all four being worked by levers of the piston rod of the intermediate pressure cylinder.

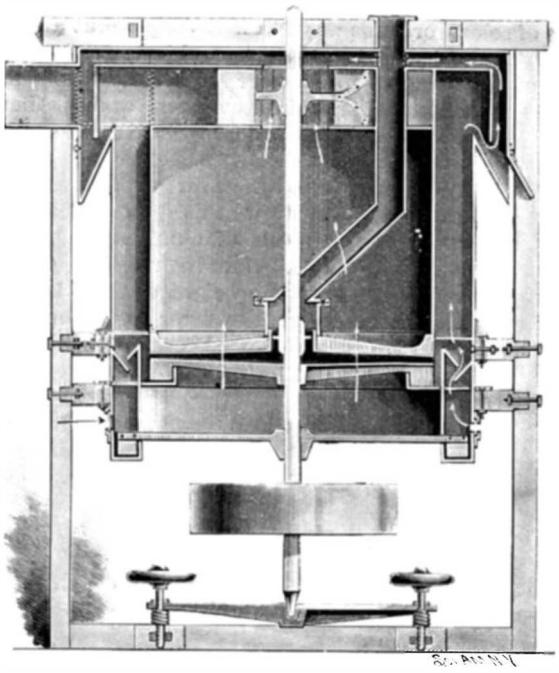
The boilers for supplying steam—which are two in number, of the Lancashire type, with a 120 pipe economizer—were supplied by the makers of the engine. The following are the principal particulars of the plant:

Engines.	
High-pressure cylinder	13 in.
Intermediate-pressure cylinder	20 in.
Low-pressure cylinders (two)	21 in.
Stroke	36 in.
Steam pressure	160 lb.
Indicated horse power	325
Air pump, single acting	12 in.
Circulating pump, single acting	10 in.
Cooling surface in condenser	640 sq. ft.
Boilers (two).	
Length of shell	28 ft.
Diameter of shell	7 ft. 6 in.
Diameter of flues	3 ft.
Test pressure	250 lb.

Messrs. Hick, Hargreaves & Co. are well known makers of large high class engines, such as are required for cotton mills for which large power, steady driving and economy are demanded, and have in one year, we are informed, turned out about 25,000 i. h. p. of such engines, with the corresponding boilers and mill gearing.

A GRAIN SCOURER, POLISHER, AND SEPARATOR.

The illustration represents a machine having an upper fixed and a lower revoluble screen between which the grain is fed centrally and passed out peripherally, a suction fan forcing a current of air through the screens, whereby the grain is thoroughly scoured and polished, the screenings and other impurities being at the same time separated from the grain. By means of an inlet chute the grain is passed through a central feed opening in the middle of the upper screen, there being a feed screw arranged upon the vertical shaft in the feed opening to press the grain coming down the chute into and between the two screens. The lower end of the vertical shaft on which the lower screen is mounted is set in a step supported at its ends on springs, whereby the scouring disks will be self-adjustable when the stream of wheat is not regular, hand wheels being provided to enable the miller to adjust the machine while in motion to scour hard or light. The grain is discharged from the peripheries of the screens into an annular receptacle into which extend wings on the under side of the rim of the lower screen, whereby the grain is forced upward on the outer wall of the receptacle, finally passing over the edge upon an inclined flange extending into an annular casing supported on the main frame. The grain is thence discharged upon another inclined flange, and falls through into a discharge channel in which operate wings secured on a spider rotated by the central shaft, the channel having an outlet chute through which the scoured and cleaned grain is discharged. A suitable suction fan with fan wheel is secured on the vertical shaft centrally in the top of the casing, and the air current through the separating chamber, as shown by the arrows, is regulated by a ring with slotted holes working over similar holes in the outer casing, all the air holes being closed and opened at the same time alike all around the machine. The arrangement is such that the grain is subjected to two distinct currents of air, the first passing through the grain while it is being acted on by the screens and the second current passing up through the annular separating chamber. This machine has been in practical use a sufficient time to demonstrate that it runs with comparatively small power to do excellent work, and it is not expensive to build. The invention forms the subject of a patent issued to Mr. George E. Russell, deceased, and further information relative thereto may be had of the administrator, Mr. Charles S. Russell, care of Hardesty Bros., Columbus, Ohio.



RUSSELL'S GRAIN SCOURER AND SEPARATOR.

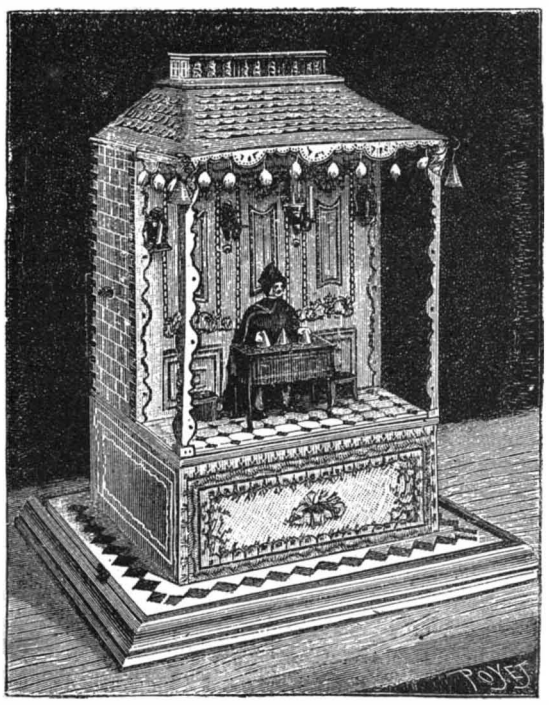


Fig. 1.—AUTOMATON REPRESENTING A JUGGLER PLAYING WITH BALLS.

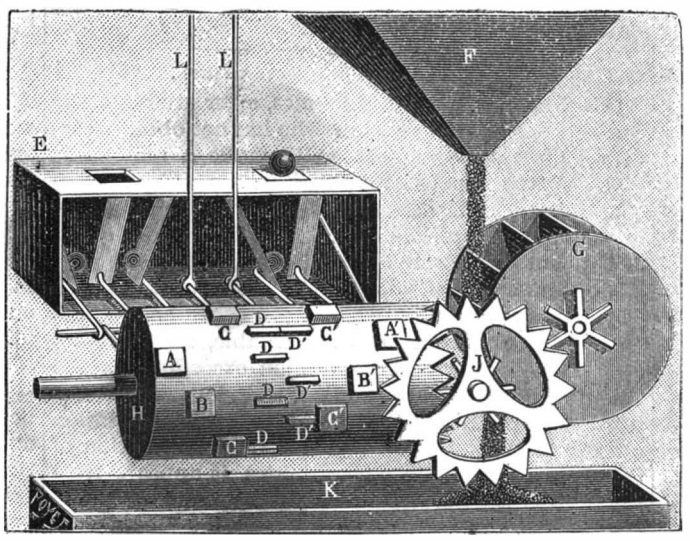


Fig. 2.—INTERNAL MECHANISM OF AUTOMATON.

A CURIOUS AUTOMATON.

The automaton figured herewith has the peculiarity of being actuated by a simple flow of sand, and what renders it still more curious is that the epoch of its manufacture dates back to the first half of the 18th century. This unique piece belongs to Mr. Gaston Tissandier, and we have been enabled to study it in detail upon taking it apart in order to repair it.

The image, clad in an oriental costume of bright colors and seated behind a little table, presents its back to a brick and stone structure of the style of Louis XV., painted white in front, and ornamented with blue and gold fillets. The structure is capped with a slate roof, which is itself crowned with a sort of belvedere. All this is of cardboard, and each accessory object, such as the stools to the right and left of the automaton, the sconces with their candles, and the small lamp suspended in the center, is a masterpiece of patience and exactitude (Fig. 1).

When the automaton is in motion it acts as a juggler. The arms rise alternately or in unison and lift the cups, and, at every motion, expose upon the table, first, to the right, a white ball, which disappears and passes to the left, and then, to the left, a red ball, which passes to the right and disappears. Then two white balls make their appearance upon a new motion of the cups, and these are changed into red ones at the next motion.

These results are obtained as follows: Let us begin by removing the little belvedere that crowns the whole, and then fill the receptacle that we observe in the edifice with fine sand. This done, let us allow the sand to fall by drawing out a small strip of metal which closes the aperture at the bottom of the hopper, F (Fig. 2). The sand flows in a continuous stream and causes the wheel, G, to revolve with great rapidity. To this wheel are fixed six tappets which engage with a toothed wheel, J, which thus diminishes the rapidity. This wheel itself, provided at the back with tappets, communicates through the latter a slow and continuous motion to the cylinder, H, which causes the automaton to act as follows: Opposite the cylinder there are two series of levers of four each, the extremities of which we suppose to be marked A, B, C, D and A', B', C', D'. The two levers, D and D', lift the arms, L, L, and the extremity of each of the six others is placed under a small strip of cardboard. Each of these strips is hinged by one of its extremities to the table, the other end, on rising, places itself just beneath the small aperture in the table, E. If now we examine the cylinder, B, we shall see that it is provided with a series of cams, A, B, C and A', B', C', and opposite these, other and smaller ones, D and D'. Each cam, when the cylinder revolves, strikes in turn one of the levers. The larger cams lift the levers and consequently the hinged cards, with the balls of different colors, and keep them lifted for some time, and during this period the smaller cams act upon the levers of the arms that hold the cups. In this way, the balls are in place when the arms rise, and do not disappear, in order to be replaced by others, until the arms have descended. The cams, A and A', cause the red balls to act, and the white balls are raised by the cams, C and C'. As for the cams, B and B', they act upon strips of cardboard that merely support obturators for the apertures in the table.

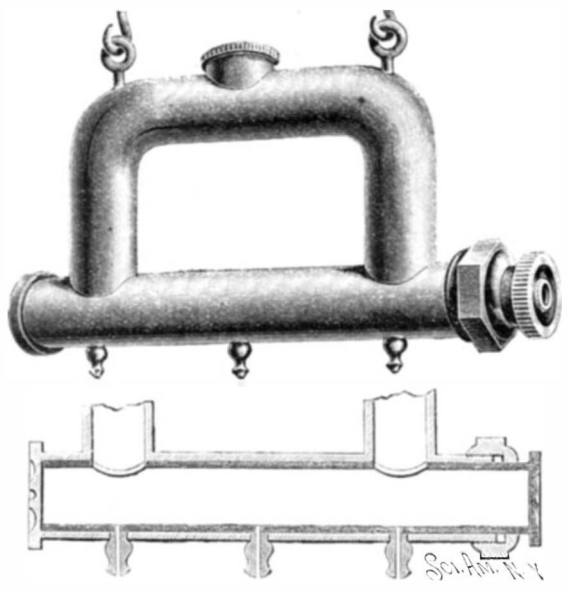
Such is the ingenious mechanism of this little work of art, which it would not be impossible to construct from the above data. We again state that all the parts of the mechanism are of cardboard, and, further, that the levers are formed of the very thin wire used in the manufacture of artificial flowers.—*La Nature.*

Help for the Russians.

The American steamer Indiana lately sailed from Philadelphia with about 4,000 tons of grain and flour, the generous gift of the citizens of that noble town to the suffering people in Russia. The railroads transported the cargo free, and all who dealt with it, from truckmen and stevedores down to insurance companies, rendered free service. This ship was soon followed by the steamer Missouri, from New York, carrying about 3,000 tons more of meal and flour to the famine-stricken Russians, the generous contributions of Western millers and farmers. The use of the steamer was also given free of charge, by the Atlantic Transport Line. The total contributions to the Russians, so far, reach the sum of about half a million dollars.

AN IMPROVED LUBRICATOR.

The accompanying illustration represents an improved device designed to deliver oil upon moving mechanism, and especially adapted to be suspended above moving belts to keep them well oiled. It has been patented by Messrs. Albert A. Taylor and William C. Edwards, of Cornwall, N. Y. The lower cylindrical reservoir has drip tubes on its under side, and connected with its opposite side is a yoke-like upper reservoir having at the top an inlet opening provided with a removable screw cap, there being eyes near the ends of the upper reservoir to enable the device to be conveniently suspended in any desired position. Within the lower reservoir is a cylindrical valve which extends the entire length of the reservoir and projects from its open end, fitting closely in the packing nut, and its outer end terminating in a head with a milled edge. The valve has openings registering with the ends of the yoke-like reservoir, and it also has perforations registering with the bores of the drip tubes, the slight turning of the valve preventing any oil from passing through the tubes, while it may be so turned as to cut off entirely the supply from the yoke-like reservoir. The valve is preferably adjusted by turning it, but it may be made to slide endwise with the same effect, being readily adjustable to nicely regulate the flow of oil.



TAYLOR & EDWARDS' LUBRICATOR.

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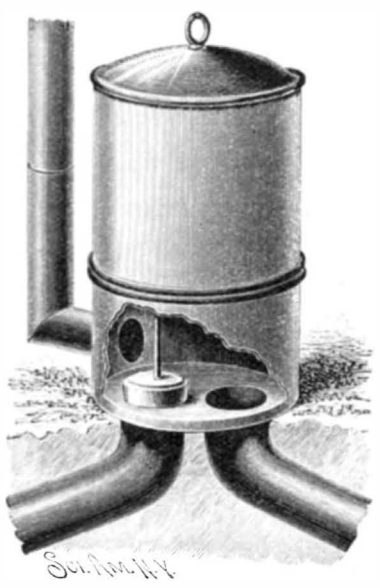
AN IMPROVED RAIN WATER CUT-OFF.

By means of the cut-off spout shown in the illustration a portion of the water from the roof may be discharged into the sewer, and, after the first water has been run off, carrying away the accumulated dust, etc., the stream may be readily diverted into the cistern or other reservoir. The improvement has been patented by Mr. Edward A. King, of St. Joseph, Mo. The roof spout leads into a receiving chamber, preferably made in two sections, and provided with a lid or cover, this



KING'S CUT-OFF SPOUT.

chamber having two outlets in its bottom for the discharge of water to the cistern or the sewer, while the receiving inlet is low down in one side. All these openings are surrounded by nipples to facilitate the connection of the pipes with the chamber. A plug or stopper is provided for the closing of either of the bottom outlets, the stem of the plug extending up within convenient reach when the cover is removed. The first water from the roof is directed into the sewer by placing the plug in the cistern pipe, and after the roof has been well washed, the plug is changed to the other opening, closing the sewer pipe and leaving the cistern pipe open, so that the clean water will pass into the cistern. The several parts are preferably made of terra cotta or other earthenware, to secure cheapness and durability of construction, and by making the receiving chamber in two parts it can be more cheaply made and transported.

Tests of Life-line Rockets.

One of the most important tests lately held for firing life-line rockets by life-saving crews to disabled vessels was made at Craney Island, Va., under the supervision of Lieut.-Commander W. T. Burwell. The test was made in a twenty-mile wind. Four rockets were tested. Each weighed 150 pounds and was fired with the following results: First, 1,200 feet; second, 1,552; third, 1,750; fourth, 2,218. The time of flight of the first two was seven seconds each; third, eight seconds; fourth, ten seconds.

Sulphonal.

In a lecture delivered at the Congress of German Neurologists in Baden, June, 1891, Dr. Gilbert, of Baden Baden, describes four cases which were treated in the sanatorium there. Two of the patients were under treatment for the sulphonal habit, as it had become a perfect mania, so much so that the absence of it caused symptoms similar to those experienced when overcoming the morphia habit. This was not the case with the other two, but serious symptoms were evident. Besides the well known injurious effects produced by the use of sulphonal, all the four patients were unable to write straightly and distinctly. The characters were unsteady, and in an ascending line from left to right. Attention is called to the fact that although the effects of sulphonal are well known, still it is used as freely as ever. In Germany it can even be obtained at chemists' shops without medical prescription. In conclusion, when the use of this drug seems unavoidable, it is recommended that it should be prepared as follows: Boiling water is poured on the dose of sulphonal, and the mixture is cooled by constant stirring until it is just palatable. By this means precipitation is nearly avoided, and the drug enters the stomach in a dissolved form. Thus sleep is said to be generally produced in from fifteen to twenty minutes, and the troublesome feeling of weariness, enervation, etc., usually experienced by the patient on the day following the use of sulphonal does not appear.—*Lancet.*

FIFTY cents per pound is now the price for aluminum in large quantities.

Alloy for Bearings.

The formula used on the Pennsylvania Railroad in making the standard bearings patterned after alloy "B" is as follows:

	Pounds.
Copper	105
Phosphor bronze, new or scrap	60
Tin	9¾
Lead	25¼

By using ordinary care in the foundry, keeping the metal fairly well covered with charcoal during the melting, it is entirely possible to get perfectly successful castings in car bearings on the above formula. The copper and the phosphor bronze can be put in the pot all at once before putting in the melting hole. The tin and lead should be added after the pot is taken from the fire.

It is, of course, a fair question whether the introduction of a little zinc, or possibly some other combinations of the six or eight metals commonly used for alloys, will not give a bearing metal much better than the alloy "B." All that I can say on this point is that alloy "B" represents the best knowledge that we have on the subject at present, and the whole thing may be summed up by saying that at present the best bearing metal that we know of is a copper-tin-lead alloy, containing a small amount of phosphorus, in which the proportions of the constituents are approximately those shown above.

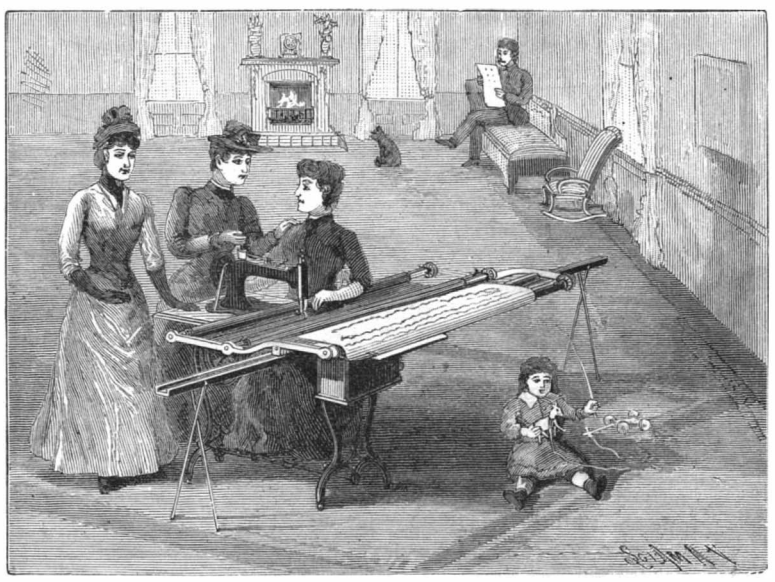
A satisfactory bearing metal should be of such a nature that it will sustain the load without crushing; that it will work well in the foundry; that it will not heat readily; that it will make the friction between the rubbing surfaces as low as possible, and that it will give the highest possible mileage with the smallest possible loss of metal by wear. It is believed that the metal described fulfills all these requisites as well as any alloy now known.—*Dr. C. B. Dudley.*

What the Census Determines.

One of our exchanges concludes, after studying the census, that probably no one who has not obtained information on the subject could make a reasonable guess at the number of places in the United States containing one thousand or more inhabitants. The guesses by the uninformed are usually from 10,000 to 15,000, but the United States census discloses only 3,715. Moreover, there are only 2,552 that have a population exceeding 1,500. At the other end of the line the returns are no less remarkable, for there are only seven cities with a population exceeding 400,000. There is abundant room for growth in these cities and towns, but the places with 1,000 or more population already contain 41 per cent of the total population of the United States. The larger cities, it appears from the returns, are growing more rapidly than the country at large. Thus in 1880 there were 286 places having 8,000 inhabitants or more, the combined population of such places being 22 per cent of the whole. In 1890 there were 448 such places, containing 29 per cent of the whole population.

AN IMPROVED QUILTING MACHINE.

The accompanying cut represents a new and valuable attachment for all family sewing machines, as by its use one lady can quilt comforts, quilts, coat linings, dress skirts, and any other article which it is desired to have filled with cotton or wool. The construction is simple, and any one who can run a sewing machine can operate one provided with this attachment. The top of the work to be quilted is rolled up on the inside roller, and the lining of the goods is rolled up on the outside roller, the cotton or wool is laid on the lining,

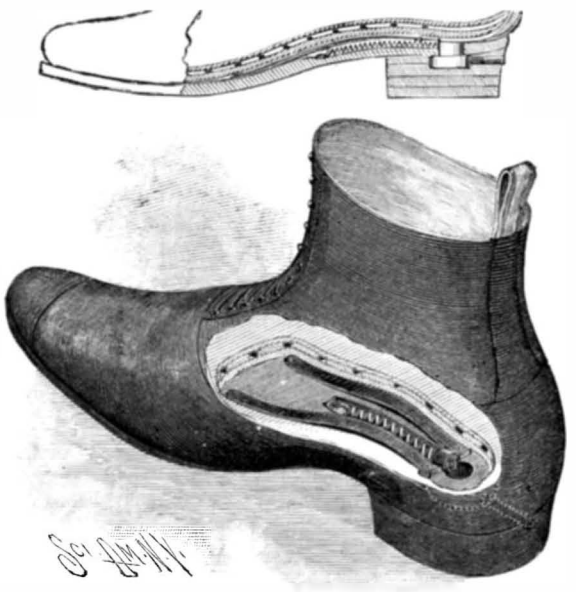


DAVIS' NEW FAMILY QUILTING MACHINE.

one layer at a time, and as the goods are quilted the quilted parts are rolled up on the inside roller. These operations are repeated until the goods are all quilted. This machine is manufactured by the inventor, Henry T. Davis, 18 to 30 W. Randolph St., Chicago, Ill., U. S. A.

SANITARY, VENTILATED BOOTS AND SHOES.

Wool, hair, fur, and feathers—consisting essentially of the same constituents—are the natural covering of animals in every clime and at all seasons. Many attempts have been made to popularize wool-lined shoes, especially for winter wear; but in none of them has effectual provision been made for ventilation, where it is more especially needed. Consequently the perspiration was arrested, or retarded, or retained in the shoes, to obviate which the ventilated shoe was



GREEN'S VENTILATED BOOT OR SHOE.

invented, and improved, as shown in the accompanying illustrations. The cuts are nearly self-explanatory.

The sectional views represent the lower part of the shoe, showing the ventilating device in detail. The shoe is lined with the so-called "Jaeger sanatory all-wool fabric." Immediately beneath the foot is an exceedingly porous felt insole lining. Under this lies the insole, made of tough wool felt, also porous and freely perforated, thus facilitating the passage of air to and from the foot, by way of the air duct opening externally at the heel, and communicating with the air well in the heel. Between the insole and the usual leather outsole, another layer of porous wool felt is used as a filling. As these three layers of wool, and one thickness of leather, are not held in position by any adhesive substance, but by stitches at the edges only, there is nothing to interfere with the free passage of air, in and out, throughout their entire length, with each step of the foot. The circulation of the air is promoted by the action of the steel shank springs, which facilitate the pumping action at each movement of the foot; and the spiral spring tube lying between the springs keeps the passage open to the air well in the heel. This ventilated shoe has been patented by Mr. John Green, and further information respecting the above described invention may be obtained by addressing the Dr. Jaeger's Sanitary Woolen System Co., 827 and 829 Broadway, New York.

The Wear on Heels.

Charles Schuette, the shoemaker, said: "Very few men are knock-kneed, a fact that is proved by not one pair of shoes in a hundred coming in to be repaired with the heels worn down on the inside. The percentage of soles worn this way is a little larger, but that is often caused by the toes being turned in instead of out. About one man in ten will wear his heels down at the extreme rear, but for every one of these there are at least half a dozen who will wear the outside right to the welt before the center shows any signs whatever of giving out. Physicians say that this bow-legged tendency is the result of children being encouraged to walk before their legs are strong enough to bear the weight of their bodies, and if this is so, the error must be very general. In making shoes to order it is usual to run two or three extra rows of nails or brads where the tread is heaviest, and some customers ask to have iron protectors driven in. The best device of this kind is a steel wedge driven into the leather, which thus cannot wear down any faster than the steel, but the objection to this is that when a man walks on a granitoid sidewalk, he makes almost as much noise as if he was wearing military spurs."—*St. Louis Globe-Democrat.*

WHITE lead is poisonous to most people; but there are examples of individuals who are unaffected by it. John Jarvis worked for over 50 years in the well known white lead establishment of Wetherill & Brother, Philadelphia, and always enjoyed good health. He lately died of old age. Thomas McCann was another example. He worked over 55 years in the same concern.

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Correspondence.

Molasses in Mortar.

To the Editor of the Scientific American:

In see in your issue of February 27 a letter from Big Stone Gap, Va., in regard to sugar in mortar. In repairing and modernizing a residence, my plasterer had occasion tear off a plastered ceiling that had molasses spilled above and run through on plastering. The rest of ceiling came off easily, and he had to take off the laths to remove the part that had been soaked with the molasses. Hence I am sure that his discovery is a very useful one, and will prove a success when it comes into common use. W. T. HANKS.

Eminence, Ky., February 29, 1892.

Visibility of the Proposed Odd Fellows' Temple.

To the Editor of the Scientific American:

In a recent copy of your excellent journal, I find the statement—presumably indorsed by you—that the proposed Odd Fellows' Temple, in Chicago, 556 ft. high, will be visible for 60 miles.

Is not this statement rather deceiving? First, because inland, where there might be hills or other elevations, the atmosphere is always too hazy (especially near Chicago) to see that distance. Secondly, out on the lake, supposing the atmosphere to be perfectly clear, an observer at 32 miles distance would have lost sight of the building below the horizon, while to see it at 60 miles distance one must stand at an elevation of 2,166 ft. above the level of Chicago.

FLORENCE B. LINING.

Philadelphia, March 6, 1892.

[Our correspondent is correct, and the statement we copied from is wrong.—ED.]

Occupation for Old People.

To the Editor of the Scientific American:

Perhaps a suggestion from an irrigating district on this subject would be in order.

It is my opinion that about eight out of ten of the old men, and ladies too, would take kindly to a small garden, could they have a wind mill and pump for irrigating.

I would suggest that they begin, not for a livelihood, but for the purpose of enlivening others. Grow all they can, and sell everything at the very highest price possible.

This they can conscientiously do, when the object ahead is pleasure for others.

Let the proceeds be divided: First, for the happiness of others; second, for enlarging or perfecting operations; third, for the "rainy day."

Of course, each particular person could decide as to the per cent to be set aside for each particular purpose.

Could the above suggestion be the means of giving one day's happiness to one person, I will, indeed, be amply repaid, and would take pleasure in giving any hints or help to any one taking an interest in such a project. D. D. SMITH.

Gila Bend, Arizona, Feb. 29, 1892.

Webb's Wonderful Test Plates.

To the Editor of the Scientific American:

In an article by President Morton, in your issue of this date, page 133, on "Magnitude of Molecules and Light Waves," a reference is made to Webb's "test plates," which called up recollections of "old times" in my mind that may be of interest to some of your readers.

The reference is to a "test plate" on which the Lord's Prayer, containing 227 letters, is written in the $\frac{1}{129654}$ of a square inch, or at the rate of *eight* Bibles to the square inch, the Bible containing 3,566,480 letters.

Now I have had in my possession since, I think, about 1868 one of these "test plates," on which the Lord's Prayer is written in the $\frac{1}{500} \times \frac{1}{653}$ of an inch, or the $\frac{1}{326500}$ of a square inch, and at the rate of 74,115,500 letters—being more than twenty Bibles—in the square inch.

Webb has, however, produced them up to twenty-seven Bibles to the square inch.

If not taking up too much of your valuable space, I would like further to say that I feel especial interest in these "test plates," as they were, I believe, written by Webb with a machine invented by a Mr. Peters and exhibited by him in the "great exhibition" in London, 1851, where it caused intense excitement in the scientific world. It was purchased by the Microscopical Society of London, now Royal Microscopical Society, for, I think, £500.

I was elected a Fellow of that society in 1866, and at that time there was only one of the Fellows practically acquainted with its mechanism—Mr. Virtue.

He took a fancy to me, and offered to teach me how to write with it. No less than three appointments were made for that purpose, all of which, unfortunately, fell through; and shortly afterward he died.

A few years afterward I left London, and do not know how matters now stand.

The marvel is accomplished by writing in a rectangle about 6 × 9 in a large clear hand. This is reduced by a series of levers, and reproduced at an infinitesimal point on the glass cover.

Could any society, college, university, or the exhibition commissioners obtain the loan of this machine for the World's Fair? It would prove an immense attraction to thousands of "scientific Americans," and I do not doubt that for such a purpose, and under proper guarantees and guardianship, the Royal Microscopical Society would be willing to further the interests of science by loaning it. STEPHEN HELM.

Roselle, N. J., Feb. 27, 1892.

The Papyrotint.

BY J. HUSBAND.

This process has been named papyrotint, being a modification of Captain Abney's improved method of photo-lithography named papyrotype.

It is specially adapted for the reproduction of subjects in half tone, such as architectural drawings in monochrome, or subjects from nature, and it is inexpensive. Its advantages over other methods of half tone photo-lithography are that a transfer can be taken in greasy ink for transfer to stone or zinc, direct from any negative, however large, without the aid of a medium, the grain or reticulation being obtained simply by a chemical change. The transfer paper being in direct contact with the negative, the resulting prints are sharper than those by processes where interposed media are used, while the same negative will answer either for a silver print, platinotype, or a transfer for zinc or stone.

The method of manipulation is as follows: Any good surfaced paper is floated on a bath composed of—

Gelatine (Nelson's flake)	1½ oz.
Chloride of sodium (common salt)	½ "
Water	13½ "
Chrome alum	6 gr.

Great care should be taken that the solution is not overheated and that the paper is coated without bubbles.

The paper is coated twice with the above solution, dried and floated in a 25 per cent solution of bicarbonate of potash. It is then dried in a temperature of 60° F. The film will take about ten hours to dry, and in this state will keep for years. The paper is very hygrometric, and must be kept in a dry place. When required for use it should be sensitized by floating, or immersing in a bath of—

Bichromate of potash	1 oz.
Chloride of sodium	½ "
Ferridcyanide of potassium	100 gr.
Water	30 oz.

This need not be done in the dark room, as the solution is not sensitive to light.

The paper after sensitizing is dried in a temperature of 70°, and in a dark room. When dry it is exposed under any half-tone negative in the ordinary printing frame. It is preferable to print in sunlight, and for negatives of medium density an exposure of three minutes is required, but the exposure will vary according to the density of the negative. The correct time of exposure can best be judged by looking at the print in the frame. When the image appears on the transfer paper of a dark fawn color, on a yellow ground, the transfer is sufficiently printed. It is put into a bath of cold water for about ten minutes until the soluble gelatine has taken up its full quantity of water, then taken out, placed on a flat piece of stone, glass or zinc plate, and the surface dried with blotting paper.

The action of the light has been to render the parts to which it has penetrated through the negative partly insoluble and at the same time granulated; a hard transfer ink is now used, composed of—

White virgin wax	½ oz.
Stearine	½ "
Common resin	½ "

These are melted together in a crucible over a small gas jet and to them are added 4 oz. of chalk printing ink, and the mixture reduced to the consistency of cream with spirits of turpentine. A soft sponge is saturated with this mixture and rubbed gently over the exposed paper (in this stage the nature of the grain can be best seen). An ordinary letter-press roller, made of "Acme" composition, charged with a little ink from the inking slab, is then passed over the transfer, causing the ink to adhere firmly to the parts affected by the light, and removing it from the parts unacted upon. It will be found that with practice, rolling slowly and carefully as a letter-press printer would his form, the ink will be removed by the roller according to the action that has taken place by light, leaving the shadows fully charged with ink, and the high lights almost clear, the result being a grained transfer in greasy ink. The transfer is next put into a weak bath of tannin and bichromate of potash for a few minutes, and when taken out the surplus solution should be carefully dried off between clean sheets of blotting paper.

The transfer is hung up to dry, and when thoroughly dry, the whole of the still sensitive surface should be exposed to light for about two minutes. A weak solution of oxalic acid or phosphoric acid for zinc should be used for damping the transfer (about 1 in 100), and this should be applied to the back of the transfer with a soft sponge. After it has been damped about four times it should be carefully put between clean sheets of blotting paper and the surplus moisture removed. A cold polished stone is then set in the press, and after everything is ready the transfer is placed on the stone and pulled through twice, the stone or scraper is then reversed, and again the transfer is twice pulled through. A moderate pressure and a hard backing sheet should be used, care being taken not to increase the pressure after the first pull through. The transfer is taken from the stone without damping, when it will be found that the ink has left the paper clean. Gum up the stone in the usual way, but if possible let the transfer remain a few hours before rolling up. Do not wash it out with turpentine, and use middle varnish to thin down the ink.

It should have been mentioned that varying degrees of fineness of grain can be given to the transfer by adding a little more ferridcyanide of potassium in the sensitizing solution, and drying the transfer paper in a higher temperature, or by heating the paper a little before exposure, or by adding a little hot water to the cold water bath, after the transfer has been fully exposed; the higher the temperature of the water, the coarser the grain will be. The finer grain is best suited to negatives from nature when a considerable amount of detail has to be shown.

The coarse grain is best for subjects in monochrome, or large negatives from nature or architecture, etc., where the detail is not so small. Even from the finer grain several hundred copies can be pulled, as many as 1,200 having been pulled from a single transfer, and this one would have produced a great many more if required.—*Jour. Photo. Soc. of India.*

Government or Municipal Ownership.

I have made a special effort, as evidence of our impartiality, to get together at this meeting some of those who believe in the abolition of private enterprise and in the surrender of all the ideas that make us crave for a home of our own and the accumulation of a few dollars for a rainy day. If we are wrong in the opinion that self-help is the best help, and that ten well-to-do citizens count more for the community than twenty superfluous officeholders, it is time we knew it. Some people want the government to run the railroads and some want it to buy up the telegraphs and telephones. Others want the municipalities to own street railways, gas works, and electric light plants. In Boston there is, I am told, a demand that the city shall collect more taxes and put into public coal yards. I am reminded of my reading, as a boy at school, when I learned that the foredoomed population of a great city once set up a howl for free bread and free tickets to the circus. Now, let me say right here that public franchises are a public trust. In return for them we are to do something or agree to something that the community wants. In my humble judgment, it has yet to be proved that such a way of introducing improvements and benefits is wrong or foolish. I am a busy man, and have been earning a livelihood all my life, but I have had time enough to observe that the whole vast industrial development that has added so enormously to the comfort and happiness of life has come from the investment, under public franchises, of private capital, skill, and enterprise. The public has thus been made the partner in all the great works of the age, and has thus gained infinitely more than it could have secured if it had raised an equal amount of money by taxation, and had placed the proceeds in the hands of a vast body of officeholders for the same purposes.—*Chas. L. Huntley, Nat. Elec. Light Convention.*

Explosive Power of Benzine.

An explosion of benzine vapor at the Baldwin Locomotive Works, February 16, killed two men and seriously injured a third. The dome of a boiler had been removed, and just before the noon hour the men applied a considerable quantity of benzine to bolt and rivet heads inside the boiler to soften the rust and scale. On resuming work one of the men got inside the boiler, and a boiler maker's lamp was lowered to him. A considerable quantity of benzine vapor had probably accumulated in the boiler and mixed with air, for an explosion took place, and the body of the man inside the boiler was fired like a projectile straight upward through the dome opening and lodged in the roof trusses overhead. The overhead electric crane had to be run underneath in order to reach him. Notwithstanding severe burns and other injuries, he lived after the accident for several hours. The workman who lowered the lamp into the boiler, and who was standing directly over the dome opening, is supposed to have been struck by the body of the man inside. He was also blown upward, struck one of the roof braces, and fell on a pile of iron plates. He died in a few minutes. The third workman was standing on top of the boiler between the cab and the dome. He was thrown to the ground and badly burned and bruised.

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THOMAS STERRY HUNT.

In that most delightful essay entitled "American Contributions to Chemistry," delivered by the younger Silliman at the Centennial of Chemistry, held in Northumberland, Pa., in July and August, 1874, are the following words referring specifically to the eminent scientist whose death has so recently occurred. It says:

"The name of no American chemist occurs more frequently, or in a more important relation to the progress and development of our science, during the past quarter of a century than that of Dr. Hunt. His contributions to our science have been equally valuable in theoretical chemistry, in chemical philosophy, and in geological and mineralogical chemistry."

He was descended from an old New England family, and was born in Norwich, Conn., on September 5, 1826. His father, Peleg Hunt, was a descendant of William Hunt, who, in 1635, was one of the founders of Concord, Mass., and an ancestor of William M. Hunt, the well known architect; while on the maternal side, his grandfather was Consider Sterry, a distinguished mathematician and civil engineer, who, in 1790, published, in connection with his brother, Rev. John Sterry, a Baptist divine, a treatise on arithmetic, and later one on algebra.

His early education was acquired in Norwich, and he was destined for the medical profession by his parents, but, attracted to New Haven by the fame of the scientific development there in progress under the elder Silliman, he began the study of chemistry there, and was closely associated with the younger Silliman. For two years he continued his studies, serving part of the time as assistant in the laboratory of Yale College, and was offered the appointment of chemical assistant to the then newly established school of agricultural chemistry in Edinburgh. This, however, he declined, and in 1847 accepted the post of chemist and mineralogist to the Geological Survey of Canada, under Sir William E. Logan, which place he then held for twenty-five years. Meanwhile he also occupied the chair of chemistry in Laval University, Quebec, from 1856 till 1862, delivering the lectures there in French, and thereafter, till 1868, he filled a similar appointment to McGill University, in Montreal.

In 1872 he returned to the United States, and accepted the chair of geology in the Massachusetts Institute of Technology, made vacant by the resignation of William B. Rogers. This appointment he held until 1878, since when he devoted his attention chiefly to expert work and literary pursuits.

From these bare facts of biographical detail we turn to a necessarily brief consideration of his life work. As early as 1847 he began the contribution of a series of papers on theoretical chemistry to the *American Journal of Science*, which, originating in a review of some of the ideas put forth by Charles F. Gerhardt, led to his advancing and advocating those views, largely original with himself, which are now accepted as fundamental in our present system of chemistry. He developed a system of organic chemistry that was essentially his own, in which all chemical compounds were shown to be formed on simple types represented by one or more molecules of water or hydrogen. Dr. Wolcott Gibbs has said, to Dr. Hunt "is exclusively due the credit of having first applied the theory to the so-called oxygen acids and to the anhydrids, and in whose earlier papers may be found the germs of most of the ideas on classification usually attributed to Gerhardt and his school." An account of the growth of this branch of chemistry will be found in his paper read at the Centennial of Chemistry held in 1874, entitled "A Century's Progress in Chemical Theory."

His researches on the equivalent volumes of liquids and solids were a remarkable anticipation of those of the great French chemist Dumas, while in his "Introduction to Organic Chemistry," published in 1852 with Silliman's "First Principles of Chemistry," he was the first to define that branch as "the chemistry of carbon and its compounds." His studies of the polymerism of mineral species, as set forth in his paper on "Objects and Methods of Mineralogy," opened a new field for mineralogy, but these philosophical studies were only incidental to his labors in chemical mineralogy and chemical geology.

His researches into the chemical and mineral composition of rocks were probably more extended than those of any contemporary scientist. From his long series of investigations of the lime and magnesia salts he was enabled to explain for the first time the relations of gypsums and dolomites, and to explain the origin of the latter by direct deposition. The first systematic attempt to subdivide and classify geologically the stratiform crystalline rocks was made by him. The names Laurentian and Huronian, applied to the earliest known rocks on this continent, were given by him to two subdivisions of the Azoic period. Likewise the distinctions and designations of Norian, Montalban, Taconian, and Keweenian were originated by him and have gained an acceptance in the literature of geology. In connection with these studies he attempted the discussion of the great questions of the origin and the succession of these rocks.

He sought to harmonize the facts of dynamical geology with the theory of a solid globe, and after reviewing and controverting various hypotheses, including the igneous or plutonic, the metamorphic, and the metasomatic, all of which he rejected as irreconcilable with observed facts and as isolating chemical theory, thus showing the essential correctness of the still imperfect Wernerian aqueous view, he advanced the so-called crenitic hypothesis, in which he argued that the source of the various groups of crystalline rocks was the original superficial portion of the globe, once in a state of igneous fusion, but previously solidified from the center. This portion, rendered porous by cooling, was permeated by circulating water, which dissolved and brought to the surface during successive ages, after the manner of modern mineral springs, the elements of the various systems of crystalline rocks. These views were originally advanced in his essay on the "Chemistry of the Earth," which was published in the "Report of the Smithsonian Institution" for 1869.

His conclusions on many points of geology are embodied in his retiring address as president of the American Association for the Advancement of Science, at Indianapolis, in 1871, and in a matured form in his "Mineral Physiology and Physiography," originally published in Boston in 1886, in which may be found his theories of the origin, development, and decay of crystalline rocks set forth in detail.

Dr. Hunt was the first to make known the deposits of phosphate of lime in Canada, and to call attention to their commercial value for fertilizing purposes. The chemical and geological relations of petroleum were studied by him, and the salt deposits of Ontario were investigated by him. His researches in the chemistry of mineral waters were exhaustive, and were said to have been "more extended than those of any other living chemist." Reports and papers on these subjects by him appeared in the various volumes issued by the Geological Survey of Canada.

In 1859 he invented and patented the permanent green ink which has since been so extensively used and gave the name of "greenback" currency to the bills which were printed with it. Later he was associated with James Douglass, Jr., in the invention of a wet process for the extraction of copper from low grades of ores, consisting essentially of roasting the ore, bringing it into solution, and then precipitating the copper in its metallic form by the introduction of iron.

He was the author of more than two hundred separate papers that appeared in the transactions of various learned societies and scientific periodicals. Besides the reports of the Geological Survey of Canada, he published in book form "Chemical and Geological Essays" (Boston, 1874, 4th ed. New York, 1891); "Azoic Rocks," being Report E of the Second Geological Survey of Pennsylvania (Philadelphia, 1878); "Mineral Physiology and Physiography" (Boston, 1886, 2d ed. New York, 1890); "A New Basis for Chemistry" (Boston, 1887, 3d ed. New York, 1890). This also appeared as "The Nouveau Système Chimique" (Paris, 1889), and a Russian translation, being the initial volume of a series of foreign scientific classics, was announced for the present year. His last work, entitled "Systematic Mineralogy According to a Natural System," was published in New York during 1891.

Dr. Hunt was a popular speaker on scientific subjects, and delivered two courses of lectures before the Lowell Institute, in Boston. He served on juries at the World's Fair held in Paris in 1855 and in 1867, being made an officer of the Legion of Honor on the latter occasion, and was also one of the judges at the World's Fair held in Philadelphia in 1876. The honorary degree of A.M. was conferred on him by Harvard in 1852, that of LL.D. by McGill in 1857, that of Sc.D. by Laval in 1858, and that of LL.D. by Cambridge, England, in 1881. Also he was an officer of the Italian Order of St. Mauritius and St. Lazarus.

He was president of the American Association for the Advancement of Science in 1870 and of the American Institute of Mining Engineers in 1877. The American Chemical Society called him to its presidency in 1880, and again in 1888. He was one of the founders, and the first president by election, of the Royal Society of Canada in 1884. In 1876 he organized, in concert with American and European geologists, the International Geological Congress, was its first secretary, and vice-president at its meetings held in Paris in 1878, in Bologna, Italy, in 1881, and in London in 1888.

In 1859 he was elected a fellow of the Royal Society of London, and in 1873 he was chosen to the National Academy of Sciences. He was a member of the American Philosophical Society, the American Academy of Arts and Sciences, and abroad of the geological societies of France, Belgium, Austria, Ireland, and of other scientific bodies.

Failing health led to his retirement some three or four years ago, and since then he lived chiefly in New York City, where he had apartments at the Park Avenue Hotel, and there he died on February 12. The meeting of the National Academy of Sciences held in New York, early November last, saw him for the last time assembled with his distinguished associates. Those who had known him in his prime were then shocked at the ravages which time and illness had made upon him, but he hoped for better days and they have come to him.

Sixteen years ago, shortly after he had retired from active work, this was written of him: "Although an indefatigable experimenter and an extensive observer, Dr. Hunt is also eminently an original and philosophical thinker, and has taken an influential part in the establishment of the most matured scientific theories. He was early in the field of chemical speculation, and aided essentially in that revolution of views which has ended in the establishment of a new chemistry." M. B.

IN the February number of *Nature Notes*, Mr. Robert Morley vouches for the accuracy of a story which seems to indicate the possibility of very tender feeling in monkeys. A friend of Mr. Morley's, a native of India, was sitting in his garden, when a loud chattering announced the arrival of a large party of monkeys, who forthwith proceeded to make a meal off his fruits. Fearing the loss of his entire crop, he fetched his fowling-piece, and, to frighten them away, fired it off, as he thought, over the heads of the chattering crew. They all fled away, but he noticed, left behind upon a bough, what looked like one fallen asleep with its head resting upon its arms. As it did not move, he sent a servant up the tree, who found that it was quite dead, having been shot through the heart. He had it fetched down and buried beneath the tree; and on the morrow he saw, sitting upon the little mound, the mate of the dead monkey. It remained there for several days bewailing its loss.

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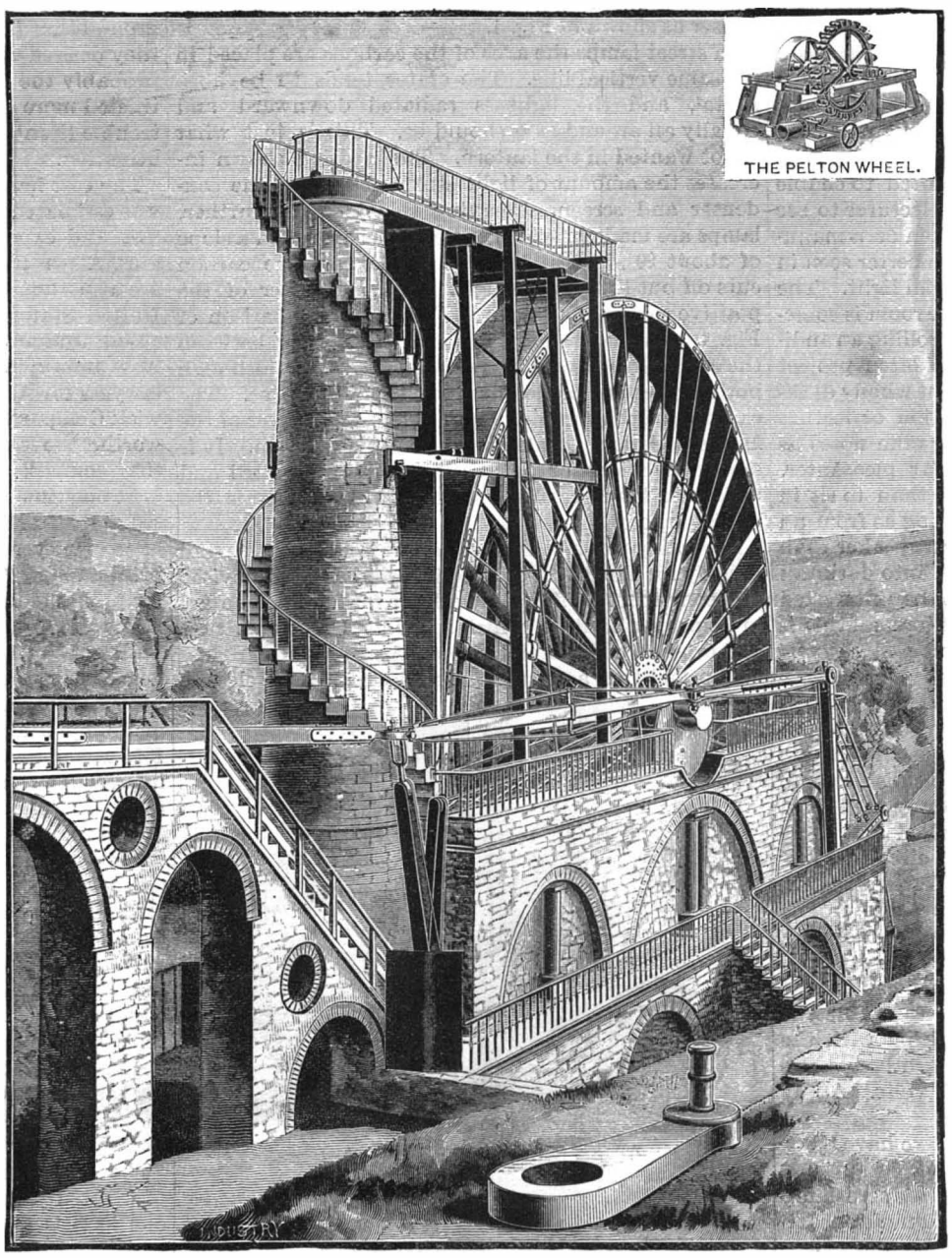
THE LARGEST AND THE SMALLEST WATER WHEEL.

The overshot water wheel shown in the accompanying illustration has the reputation of having been the most costly to build as well as that of being the largest water wheel ever constructed. It is at Laxey, on the Isle of Man, where it is used to pump water in working a lead and silver mine. The wheel is 72 ft. 6 in. in diameter, 6 ft. in breadth, has a crank stroke of 10 ft., and develops about 150 h. p. The power operates a system of pumps raising 250 gallons of water per minute, the lift being 1,200 ft. The power is transmitted several hundred feet to the pumps by means of wooden trussed rods, supported at regular intervals, the supports resting on small wheels, running on iron ways, to lessen the friction. The water to turn the great wheel is brought from a distance in an underground conduit, it being carried up the masonry tower by pressure. This great wheel was constructed some forty years ago, and has been running continuously ever since.

In the upper right hand corner of the same picture is represented another water wheel, drawn to the same scale, and which will afford as much power under similar conditions of head and water supply. This small wheel is the well known Pelton, having peculiar cup-shaped buckets on the periphery of the wheel, into which the water is so directed from one or more nozzles that nearly the full value of its weight for the height of its head or fall is transformed into the inertia of the wheel. The power represented by the force of the water is thus converted into mechanical movement, almost entirely without friction, "the buckets simply taking the energy out of the stream and leaving the water inert under the wheel." The Pelton wheel is extremely simple in construction, and is in size and appearance apparently but little more than a mere toy, in comparison with the ponderous piece of machinery shown as the great Laxey wheel, with its massive column, arches and stone foundation. Probably the cost of putting in position a Pelton wheel to afford the same power as this great overshot wheel would not be one-fiftieth of that of the earlier and cumbersome construction. Such an object lesson is of value in showing the wonderful progress in hydraulic engineering practice during the last half century.



THE GREAT OVERSHOT WATER WHEEL AT LAXEY ISLE OF MAN.

ELECTRIC LIGHT FOR MAGIC LANTERN.

PROF. W. C. PECKHAM.

There is great diversity of opinion regarding the candle power of both the calcium and electric arc lights. Makers and dealers in the calcium light claim as high as 900 candle power for it as actually used in the lantern. I have made numerous measurements in the laboratory of the Adelphi Academy upon both. The method employed was that of the Bunsen grease spot photometer, with a sight box by the American Meter Co. The standard of light was the Sugg London standard Argand gas burner and a Methven screen, by the same company. These have been compared with standard candles and are correct, or what is called so. The following table is compiled from my notes, each jet being tested three times. 1. A noiseless flame. 2. A medium flame making as much noise as would be allowable in the lantern. 3. A roaring flame, taking all the gas it will use.

CALCIUM LIGHTS.

Jet.	1	2	3		Jet.	1	2	3	
A.....	304	304	413	candles.	D.....	264	304	353	candles.
B.....	130	205	413	"	E.....	180	...	304	
C.....	264	304	491	"					

Column 3 gives the maximum beyond which these jets cannot be forced and which they cannot long maintain, since the lime would soon crumble away under such a bombardment.

A calcium light which had just been tested with a quiet flame was used as a standard by which to measure the candle power of the two arc lights for lantern use belonging to the Adelphi Academy, with the results given below.

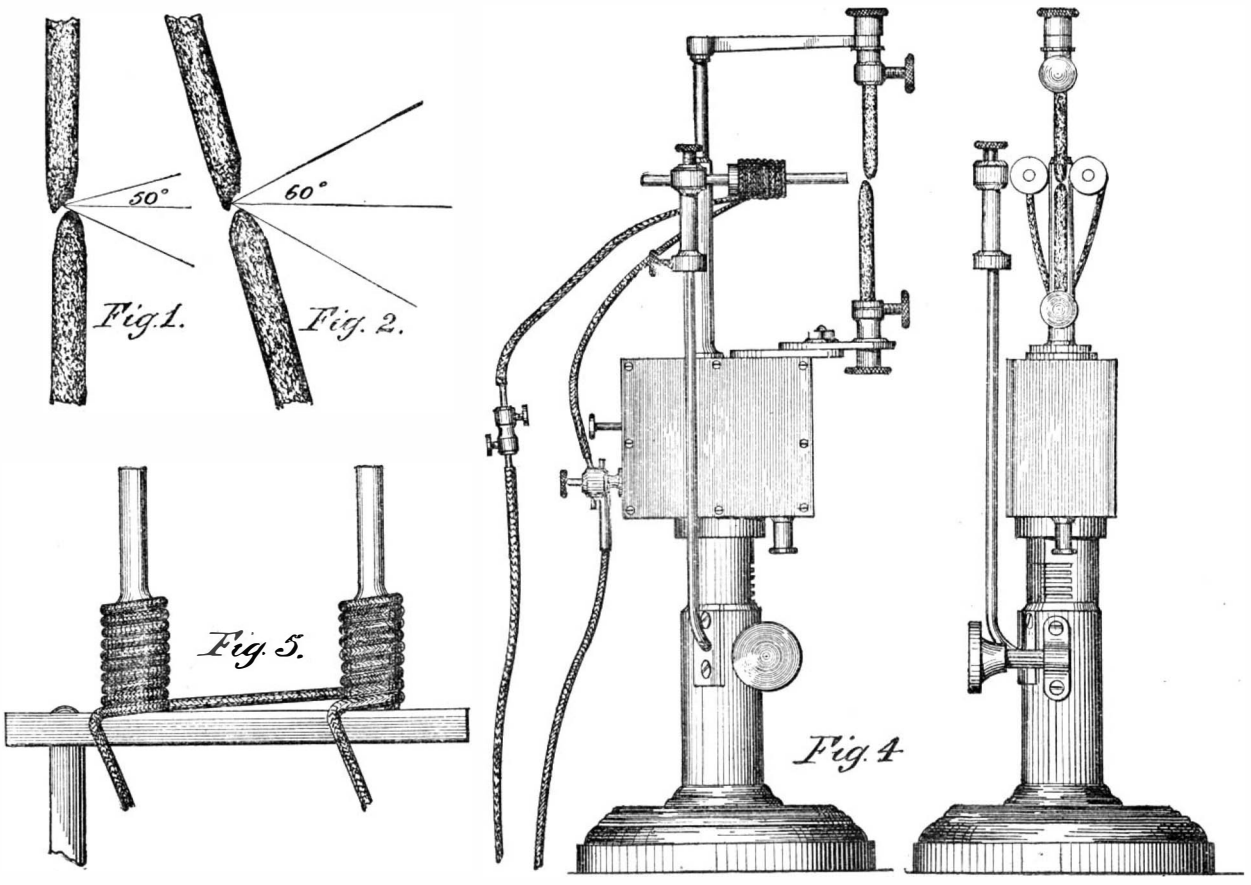
A small lamp made by the United States Electric Lighting Co., requiring about 8 amperes at 110 volts, gave 355 candles. A Clark lamp of full capacity with a current of about 15 amperes gave 1,378 candles, and with a full current of 20 amperes on gave 1,758 candles. These figures show that candle power is much overestimated in all cases. The last lamp measured is what is called a 2,000 candle power lamp. It gives in the condition in which it would be used 1,300 candles, and this is a magnificent output when compared with the 300 candles of the calcium lights.

In many places current can now be had from lighting and power circuits, while many educational institutions have their own plant, which could easily be employed for this purpose, but as yet no arc lamp of moderate price equal to the work has been put upon the market. Not to mention the old regulators, like the Foucault, with clockwork which requires frequent winding, there are several lamps costing about one hundred dollars made for this use, but that price for the lamp alone is prohibitory to many. English writers recommend the Brockie-Pell lamp most highly. The Clark lamp, spoken of above, is a favorite here. It, however, is hung down into the lantern, resting on the top of it. Its regulating magnets and mechanism are heavy, rendering the whole somewhat topheavy. To adjust the light one must reach above the top of the lantern, and if the lamp is to be removed from the lantern, a special stand must be provided for it. The lamp I have used for nearly two years was made by the United States Electric Lighting Company. It is simple in construction, rising by a rack and pinion by hand, as the lower carbon is consumed to bring the arc into focus again. Its fault is that it does not "take up" quickly when the current varies through varying resistance in the arc. With a little experience its regulation by hand, to overcome this defect, is not difficult.

Fig. 4 shows the appearance of the lamp and its interior mechanism, the sides being removed for that purpose when the photograph was made. It stands 20 inches high, with full length of carbons.

It would seem that a focusing lamp might be made for a moderate price which would, with plain, strong, and durable workmanship, be as good practically as the highest priced lamp, and that such a lamp would find a good market.

The incandescent lamp has been used in the lantern by some. In its ordinary form with a long loop of filament the light is too widely distributed. A special form has been made for the lantern of 100 candle power. The carbon filament was coiled into a close spiral of about a half inch in diameter, which is about the size of the white spot on the lime. This lamp is very easy to use, since its resistance would be fitted to the circuit upon which it was to be put, and it would run with the other lamps upon the same circuit and with no more attention. The operator has nothing whatever to do but to turn the key when the light is wanted. Where its light is sufficient nothing better can be desired, nothing cheaper be found. The lamp itself costs very little, and a support for it in the lantern can be made by any one. It is infinitely better than any



ELECTRIC LIGHT FOR THE MAGIC LANTERN.

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oil lamp. I have known them to be used in small lecture rooms in preference to the calcium or the arc light. But it is the arc light alone which can take the place of the calcium light for all uses. It leaves nothing to be desired. I cannot agree with the remark of Mr. Lewis Wright in his recent book on "Optical Projection": "Such a powerful light is quite useless for exhibitions unless the disk shown exceeds 30 feet in diameter." My experience is that the better lighted a picture is, the less the eyes of the observer are taxed. With the calcium light the deepest darkness is necessary in other parts of the hall to save the picture from indistinctness, and the reading lamp of the lecturer often blurs one side of it. When the arc light is used the illumination is so abundant that enough lamps, gas or incandescent electric, may be left lighted to enable the audience to see the lecturer and the lecturer to see his audience, so that notes may be taken or a manuscript read, while still the picture can be better seen in all its details than with any other artificial light. The ability to have other lights in the lecture room is sometimes an important consideration in controlling an audience of students. It is useful always. I often project a slide of a diagram or a machine without wholly darkening the room, and go on with recitation or lecture upon it, while the class attend, copy, or take notes as required. In a popular lecture it is far pleasanter. Nothing is more weird for an audience than to sit in deep darkness and listen to a voice coming as from an abyss beyond; nothing more unreal for a speaker than to stand upon a platform and to speak into darkness in which there may be supposed to be interested listeners. With the arc light in the lantern all this is changed, and speaker and hearer may be *en rapport* with each other in a fairly lighted room.

If the operator is on an arc light circuit, his lamp is put directly in series with the others on the same circuit, but the high potential used on such circuits makes such an arrangement rather a ticklish one to work with. The low potential generally used with incandescent lights is more safely handled and there are now many arc lamps used on such circuits. The potential is never above 110–120 volts. At this pressure the wires may be handled as safely as those from a battery. Of course they must not come in contact with each other; for a short circuit will produce a great heat.

If the arc lamp is to be used on an incandescent circuit, additional resistance is required to enable the low resistance arc lamp to burn in multiple with the high resistance incandescent lamps. Arc lamps use from 8 to 15 amperes of current at 115 volts. Apply Ohm's law to this, $C = \frac{E}{R}$ or $R = \frac{E}{C}$, and we have $\frac{115}{8} =$ 15 nearly, and $\frac{115}{15} = 8$ nearly. So an 8 ampere lamp requires 15 ohms and a 15 ampere lamp 8 ohms approximately of resistance to control the current.

A part of this is offered by the arc itself. The adjusting coils of the lamp furnish something more, differing in different lamps, but not enough to make up the resistance to the amount required to choke off an excessive current through the lamp.

There are two ways of arranging the apparatus.

1. The common way is to place a rheostat in the main circuit whose resistance can be varied at will, and thus more or less current be sent through the lamp. This is the method when the current comes from a central station at a constant pressure.

2. Where there is a separate or isolated plant, as in not a few educational institutions, a coil of No. 12 German silver wire (so that it will carry the required current without heating, with a resistance of three or four ohms) may be put permanently in series with the lamp. The remaining adjustment will be made by the field rheostat of the dynamo. For this purpose the field wires should be brought to the lantern table, and a field rheostat be connected to them within reach of the operator. By varying the field resistance he can change the voltage of the current and thus adapt it to the lamp.

The only defect of the arc light for lantern use is the "blinking" caused by the change of the position of the bright spot on the positive carbon. This bright spot emits by far the greater part of the light. To see it, place a deep red and a blue glass together and look through both. The bright spot still looks white, but the rest of the carbons looks dark red. This spot is seen frequently to move, sometimes to swing around, sometimes to jump across to the opposite side of the carbon. This motion is attributed to impurities, principally silicon, in the carbon. The best carbons, the Carré French carbons, are not free from this defect.

The blinking does not make much difference for street use. The light flickers and hisses and we endure it, but in the lantern, if the arc goes to the back side of the carbons, the picture is blurred or obliterated entirely. This motion of the arc is fatal to the use of the light for projecting microscopic objects. The light entirely leaves the focus of the objective, and comes back when it gets ready. Several microscopic societies have abandoned the arc light in disgust on this account, though when the arc is in its proper position, the illumination is superb.

The remedy for blinking has been to place the center of the negative carbon in front of the positive by a distance equal to its radius. This serves two purposes. The distance from the tip of the negative carbon to the front side of the positive carbon is the shortest and easiest path for the arc, and so the arc will remain in front of the carbons, unless something makes it move. A second object which is gained is to form the crater in the positive carbon so that it slopes toward the condenser as shown in Fig. 1.

In street lamps the axes of the carbons are placed in the same vertical line. The crater tends to be horizontal, and the light is radiated downward and equally all around as it should be. This is just what is not wanted in the lantern. The position shown increases the amount of light sent out toward the condenser and screen. Carrying this idea still further, lamps are made in which the carbons are set on a slope of about 20°, in which position the negative carbon cuts off but little of the light from the crater of the positive carbon, as is seen in Fig. 2. A comparison of Fig. 1 with Fig. 2 shows an angle of opening between the carbons 10° larger in the inclined carbons, although both figures are made from the same negative. The carbons in the focusing lamp used on the tower of the Madison Square Garden are set in this position. It is more convenient for me to tilt my lamp forward and make the lower carbon negative, which answers the same purpose.

According to my observation, this is but a partial remedy for the defect of blinking, and I have devised and constructed a special regulator for holding the arc in its proper position, which so far as I know is new and original and which has proved successful.

The fact that a magnet strongly repels an electric

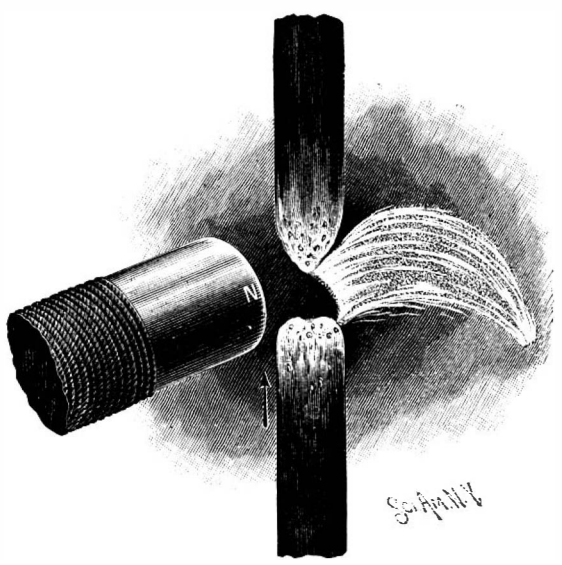

Fig. 3.—THE ELECTRIC BLOWPIPE.

arc is of course well known. Dr. Samuel Sheldon, now of the Brooklyn Polytechnic Institute, based upon this fact an electrical blowpipe which he described in the SCIENTIFIC AMERICAN of Feb. 2, 1889. The cut, Fig. 3, is reproduced from his article.

The same force in a less degree will hold the arc on one side of the carbon. At first one pole of the electromagnet was used. This worked quite well. The apparatus illustrated in Fig. 5 was afterward made, which is an electro-magnet of the ordinary form, except that the soft iron cores extend beyond the coils, so that the coils may be set back far enough that their insulation may not be destroyed by the heat. The cores are of ¼ inch rod, 2½ inches long, and set 2 inches apart. Eight to twelve turns of No. 12 wire on each core will produce a field strong enough when the poles are set about a half inch behind the carbons. The mode of attachment to the lamp is plain from Fig. 4. It will be seen that the rod which carries the regulator is attached to the base of the lamp and that the magnets can be moved forward and backward. If too near, they drive the arc out with a hissing noise. The regulator is adjusted once for all as high as the focus of the condenser, and as the carbons consume, the rack and pinion brings the arc up to its place again, with reference both to the regulator and condenser. The regulator is in series with the lamp, and the whole current goes through it. It might be in parallel, but nothing would be gained by that arrangement.

I have had it in use for more than a year with the best results. Any one can easily make one and test its working. It is confidently expected that it will enable the arc lamp to come into use for lantern projections wherever the heavy current can be had.

Torpedo Boat for Australia.

The first-class seagoing torpedo boat lately constructed for the Victorian government by Messrs. Yarrow & Co. left London for Melbourne, December 12. This vessel is 130 ft. in length by 13 ft. 6 in. beam, and on trial was found to have a speed of 22¾ knots during a run of three hours' duration in a fully equipped condition, with all weights on board.

The Law's Delay, its Heavy Costs, its Uncertainty.

During the past eighteen years the *Review* has published hundreds of columns relating to the suit of the Webster Loom Company *vs.* A. & E. S. Higgins. It now remains only to close the account, as the famous litigation may be assumed to be practically ended. On a motion being made for final argument by Mr. Walter Griffin, delay was asked for by the plaintiffs on the ground that their counsel had thrown up the case and they desired to substitute new attorneys. This means probably the final termination of a case which has attracted more attention and cost more money, time and trouble than any in the history of American patent litigation.

The cost has been something enormous. Years ago it was estimated that each side had expended $200,000 in fees and expenses. All the defendants, Elias S. Higgins, Alvin Higgins and N. D. Higgins, are dead, as are also Judge Bradley, who wrote the decision of the United States Supreme Court in favor of Webster's claim; Judge Hoar, of Massachusetts; Judge Nixon, of New Jersey; Roscoe Conkling and Geo. Gifford, the lawyers for A. & E. S. Higgins; Parker, the New Brunswick Company's lawyer; Davis, Wm. and John Duckworth, the experts; and E. N. Dickerson, the plaintiffs' counsel.

At one time the damages were calculated at $28,750,000, but after Mr. Wm. G. Smith's examination, which lasted two years, covered 6,294 questions and filled 2,384 printed pages, this claim was withdrawn and the claim for profits reduced to about $1,500,000. The Webster Loom Company's patents have expired; they never built a loom; all the defendants, as has been said, are dead, but the case has survived. And yet such is the judicial respect for previous decisions that the error made by Judge Nixon in the New Brunswick case in 1874 was not examined on its merits until sixteen years later, when the decision was pronounced radically erroneous. The master in chancery decided that the Webster Loom Company could receive only nominal damages. Judge Shipman reversed this decision. The defendants appealed, and Judge Wallace reversed his own decision of 1884. Then Judge Shipman wrote a second decision, agreeing with Judge Wallace. Beautiful uncertainty is the essence of law.

And yet in 1887 Mr. Griffin discovered that since 1856 the Roxbury Carpet Company had been using Johnson's wire motion, which the master decided to be better than Webster's. So there was really never any foundation for the action.—*Carpet Trade Review.*

Causes of Carpet Sprouting.

The surface of a Brussels carpet is composed of loops of worsted yarns packed closely together. When any one loop is formed, the particular worsted thread of which the loop is a portion sinks beneath the linen or cotton cross thread (weft) and remains with other threads in the body of the fabric until it is required to form another loop on the surface. These surface loops are held in position by the cross threads (weft), the closeness of the fabric and the intermingling of the various strands of worsted. Not being tied or knotted down, should any loop be caught or pulled by a sharp point in brush, broom, boot, paw or claw, then the worsted underneath will be drawn above the surface and the loose ends and tag will form a well developed case of sprouting.

The trouble is especially liable to occur in first-class goods in which the yarn is fine, soft and highly dressed, and in carpets in which the ground is not well covered. In grounds well covered the threads cross each other frequently and are thereby held down more firmly.

There is but one remedy, and that is to clip off at once all the loose ends. With careful, close clipping the threads by degrees get flattened down and the trouble ceases.

In every case of complaint from a customer the dealer should be especially careful to place the matter in the hands of an experienced employe, whose special business should be not only to see to the remedy, but also to ascertain the cause of the trouble. He should keep a sharp lookout for dogs and cats, whose paws or claws may have started the threads. The casters of all articles of furniture in the room should be examined, and likewise all legs of tables, chairs, etc., not provided with casters. A rough caster or a jagged end of wood has caused many a case of sprouting. Nails in boot heels have likewise much to answer for in this direction. Parrots, given the freedom of a room, are apt to use both beaks and claws on a carpet with disastrous effect. But the worst enemy of carpets is the common broom in the hands of a maid more muscular than intelligent. If possible, the housewife should avoid sweeping a new Brussels carpet for some months; that is, until the loops get trodden down somewhat. If sweeping is regarded as absolutely necessary, the only proper thing to use is a good carpet sweeper run over the carpet with the utmost possible care.—*Carpet Trade Review.*

A MYSTERIOUS ringing of electric bells in a Swiss house was traced to a large spider, which had one foot on the bell wire and another on an electric light wire.

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RECENTLY PATENTED INVENTIONS.

Railway Appliances.

TRAIN SIGNALING DEVICE. — John Lyuch, Jamestown, North Dakota. This is a simple and inexpensive device designed to afford means to reliably signal, either by night or day, that the track is clear, or that train orders are awaiting a train from either direction. A rectangular main semaphore blade is supported on the outer end of a horizontal bracket arm, the upper half of the blade colored white, while there is a pendent auxiliary blade on each side of the main semaphore blade, colored red on the sides shown when pendent and white on the sides shown when rocked upwardly, there being journaled on the horizontal bracket arm a rock shaft for each auxiliary blade, with a device for rocking each shaft from its inner end and locking it.

CAR.—Mansel L. Heacock and Thomas H. Lovejoy, Portland, Oregon. This invention provides an improvement in car construction, affording a means whereby a car body may be conveniently and quickly changed from an open to a closed car, and *vice versa*. The sides of the body have spaced upright posts, and a series of sliding panels is provided, there being a series of sashes above the panels pivotally connected to the car structure at their upper ends to separately swing inward and upward, with latch devices whereby when the panels are carried upward to an engagement with the sashes the two are locked together. The improved construction is designed to be simple, durable and inexpensive.

CAR. — DeWitt B. Williams, Prescott, Arizona. This is a car adapted to be readily changed from a box car to an open car and *vice versa*, and, when used as a box car, to be readily opened at any part to unload some of the contents without disturbing the rest. The platform carries corner posts which support a band formed with longitudinal slots, while a series of doors have flanges at their upper ends engaging the slots, there being a locking device for fastening the lower ends of the doors in place, and longitudinal rods for supporting the doors in an uppermost position inside the car.

CAR HEATER.—Lawrence Haas, Grand Crossing, Ill. The body of the heater provided by this invention is designed to be set in the car floor, so that its top will be flush with the floor. Around the fire pot is a jacket, forming an inclosed chamber, in the lower part of which is a spiral partition, oppositely arranged funnels communicating with the lower part of the chamber, while a valve is pivoted between the funnels. The air entering the funnel is compelled by the partition to take a spiral course around the fire pot, by which it is heated and is passed into pipes leading to both sides of the car. When the car travels in the opposite direction, the valve changes automatically to direct the air into the opposite funnel, whereby the heated air will pass upward as before.

RAILWAY TIE.—Thomas C. Anderson, Moscow, N. Y. This is a metal tie consisting of two vertically separable parts, the upper of which has inclined bridges near the ends, and wedges adapted to fit between the bridges and the bottom portion of the tie. The object is to produce a cheap and durable tie so constructed that it may be easily laid and will hold the rails securely in place, while it may be readily adjusted in any kind of weather to bring a rail to the desired height, and also has all the elastic qualities of wood.

BELL RINGER. — John L. Baker, Baird, Texas. This is a device especially designed for use in locomotives, being effective and automatic, and arranged to impart a uniform motion to the bell crank shaft without jar or pounding. The invention consists of a cylinder provided with a steam chest in which is held a plunger valve, three plungers being arranged to lead the motive agent from one end of the cylinder to the other end to form a cushion for the piston.

SPRING BOX FOR CAR COUPLINGS.—Patrick P. McMahon and George M. Wilcoxson, Chattanooga, Tenn. This is a detachable box or case for the secure retention of a buffer spring for a car coupling which will permit the spring to be changed quickly if broken, and which can be utilized in conjunction with different styles of drawheads. The box consists of two parallel side walls having interior stiffening webs and exterior locking ribs, and two transverse apertured walls integral with the side walls and forming therewith a spring chamber, the side walls projecting beyond the transverse walls.

SWITCH LOCK.—Jos. Judge, Pittston, Pa. Combined with a switch stand having a notched keeper is an apertured switch lever and a lock consisting of an apertured casing and a spring-pressed bolt in the casing, the keeper being adapted to pass through the aperture of the switch lever and be engaged by the bolt of the lock. The lock is so made and located that the moment the switch lever is in position to close the switch it will automatically be locked to the switch standard, and the switch lever cannot be released except with a key. The lock is simple and of few parts, and cannot be opened by striking or otherwise jarring its exterior.

Agricultural.

CORN HARVESTER.—James W. Miller, Stewartsdale, North Dakota. The construction of this device is such that the portion containing the drop mechanism and cutting blade or blades may be carried downward to cut close to the ground, or carried upward to cut the corn some distance from the ground. The cutting knife is also adjustable to any desired angle or vertically, and means are provided whereby the cut corn may be effectually guided to dumping platforms which are capable of being operated by the driver of the machine at will. This harvester is designed to be of very simple, durable, and inexpensive construction, and it is especially adapted for cutting a corn growing in the Northwest, the ears of which project from the stalk at or with their stems below the ground line.

WEEDER. — Frank Hulse, Goshen, N. Y. This is a simple machine designed to take the place of hand work, and adapted to be pushed along the ground over a row of plants, when it will pull the weeds from between the plants, thoroughly stirring the soil, and without injury to the plants. Shoes adapted to run upon the ground are secured to the lower ends of the handle bars, and converging spring fingers are arranged between the handle bars, the fingers having means for vertical adjustment.

FEED FOR THRASHING MACHINES.—Elmer E. Logan, Larned, Kansas. This invention provides a force feed of simple and inexpensive construction, capable of attachment to any thrashing machine. It consists of a toothed feed cylinder arranged above and in advance of the thrashing cylinder, and adjustable toward and from it, its teeth passing between those of the thrashing cylinder, while a carrier or elevator belt delivers to the feed cylinder. A regular, continuous and uniform force feed is thus obtained, and very satisfactory results are also realized in the process of thrashing.

Miscellaneous.

DITCHING MACHINE.—Louis A. Desy, Montreal, Canada. A swinging scoop frame is hinged at its upper end to the main frame, there being chain wheels in the lower end of the scoop frame, and the scoops are so arranged that each alternate one will cut the center of the trench and the others the edges. The ditching devices are mounted on a car or platform, and the latter is mounted on a wheeled truck. The machine is especially arranged for digging trenches of a uniform width, such as gas pipe, water main or sewer trenches, the parts being readily adjustable to dig a deep or a shallow trench. The engine has two driving sprocket wheels, one belted with the scoop-operating devices and the other arranged to be connected with the traction devices.

HYDRAULIC STUMP EXTRACTOR. — Alfred Taylor, San Francisco, Cal. This is a simple and powerful machine which may be quickly applied to pull a stump or other object to be lifted, and is easily and rapidly operated. It consists of a main frame carried on wheels and provided with crank axles, a cylinder carried by the frame having an open upper end, while a movable piston is mounted in the cylinder and projects from its upper end, the piston having a grooved head at the top adapted to carry a lifting cable, a pump carried by the frame being connected with the lifting cylinder and with a source of water supply.

WINDOW. — Jean J. Eyraud, Paris, France. This is a simple form of window which may be swung open in the usual way, and which can also be tilted or rocked to allow the air to pass above and below it. The invention comprises a vertically-swinging frame to which horizontally-swinging sashes are hinged, there being a fastening device for fixing the position of the frame, a hinged plate or shield preventing currents of air.

BOAT PROPELLING MECHANISM. — William H. Dick, Dansville, N. Y. This is a mechanism especially adapted for row boats, canoes, and such small craft, and designed to be quickly and conveniently placed in position in the boat or removed from it, being adjusted in position to the size of the boat. The seat is supported on the base of the mechanism, and upon a standard are adjustable arms supporting journal boxes in which are adjustably journaled shafts carrying paddle wheels, the paddle shafts being operated by chain belts from crank shafts. No rudder is required, as each paddle is operated independently, and no fastening devices are necessary, the weight of the device and of the operator being sufficient to hold the mechanism in place.

BEAM CLAMP AND HANGER.—William W. Canby, Philadelphia, Pa. This invention provides a novel construction of adjustable clamps for I or other shaped beams, girders, etc., to be used as a hanger for steam, gas, water and other pipes, and also applicable to bridge building or iron construction work of different kinds. The opposite jaw or clip-shaped clamp sections are provided with bent legs at their inner ends, longitudinally slotted base portions being fitted to slide one upon or under the other, the upper one having nut-locking ribs, in combination with a bolt and nuts above and below the base portions of the legs securing the clamp sections together.

HOUSEHOLD ALTAR.—Leo C. Beaudet, New York City. A compact and ornamental altar table is provided by this invention, adapted to be folded to produce an inclosing box or cabinet in which the adjunctive candelabra and vases are kept, but which may be quickly unfolded into altar form to support the sacramental altar service ware. A telescopic supporting standard and base therefor is also provided, affording a column of proper height to sustain the table suitably elevated, or allow the entire device to be greatly reduced in height if desired.

WAGON JACK. — Frederick Finsterer, Avon, Montana. Combined with a toothed lifting bar fitted to slide and a hand lever carrying a lifting hook adapted to engage the toothed bar, is a bolt fitted to slide and engage the toothed bar while being actuated from the lifting hook. The construction is simple and durable and very effective in operation, being arranged to automatically and securely lock the lifting bar in place to support the load.

CAN OPENER. — Anthony Ward, New York City. The main portion of this device is formed of a single length of wire bent to form a handle at one end and a pivot at the opposite end, the cutter having an aperture through which the wire is passed when the cutter is secured in fixed position on the wire. The device is very simple and inexpensive, and the blade is so formed that the walls of the kerf produced will be quite smooth, and when the knife is introduced into the head of the can it will not have a tendency to leave the head during the process of cutting.

CULINARY VESSEL. — Seth Williams, Sing Sing, N. Y. An improved article of manufacture is afforded by this invention, being a vessel of that class in which an inner receptacle of earthenware, granite ware, or other material, is inclosed in an outer metallic casing in such manner as to form a space or chamber for the access of heat around and in contact with the walls of the inner vessel without the vessel being exposed to the direct action of the fire. The vessel is of very simple and inexpensive construction, in which the heat from the fire will be deflected and guided to impinge upon the interior vessel at its sides and the edges of the bottom.

BURNER. — Theodore A. Williamson, Allegheny, Pa. This is a hydrocarbon burner for cooking or heating purposes, and has a bottom plate formed with a coil, connected with one end of which is an oil supply, a back plate resting on the bottom plate having a channel connecting with the other end of the coil, while one or more burners on the back plate are connected with the channel to receive the gas and oil supply. The device is simple and durable in construction, and arranged for convenient insertion and use in ordinary stoves.

MUFF. — Catharine Booss, New York City. This invention provides a simple and inexpensive device which may be easily applied to a muff to hold it in correct shape, and by which the muff may be attached to the persen. A ring, either flat or round and preferably yielding, is secured within the body of the muff, and in one side of this ring is an outwardly extending ear from which extends a chain to the free end of which a bracelet is attached, to be worn on the wrist.

SHOE HORN. — Newton A. Dickinson, Essex, Conn. This is an improvement on that class of shoe horns which have a pivoted lever to press the heel portion of a rubber or leather shoe against the lower portion of the horn, thus forming a clamping device for pulling on the shoe. The lever has its upper end curved to form a finger hold and a roller is mounted longitudinally on its lower end, the lever being pivoted to the horn and adapted to swing in a plane parallel to it. The lower ends of the horn and lever may, if preferred, be convex and concave, whereby they are adapted to fit together.

EARTH AUGER. — Bradford Lane, Carlton, Oregon. This is a device especially designed for use in digging post holes, the cutting blades being rigidly supported from a single handle, and the blades being curved or concaved transversely and having inturned bottoms, with slightly diagonal bottom edges, one side and the bottom of each blade being sharpened. This auger is calculated to effect the cutting of a large hole in an easy and expeditious manner, enabling a large bite to be quickly cut and compactly held while being removed.

PENHOLDER.—Theodore O. Earle, New York City. This holder consists of a cylinder with an opening in one side and a lever having a movable fulcrum in the cylinder, one end of the lever engaging a pen while its other end has a button extending out through an opening flush with the outer face of the cylinder. The penholding attachment adapts itself to pens of different thicknesses, and the pen is effectually clamped and held in proper position for use, or may be quickly and conveniently released and removed without soiling the fingers.

CLASP.—George W. Kuchler, Yonkers, N. Y., and Hermann C. Fischer, New York City. A device which may be utilized for clamping either heavy or light articles is provided by this invention. It is of the caliper type, in which the free or clamping ends of the arms are normally held apart by a spring, a locking lever being provided capable of forcing the arms to close upon material of varying thickness and lock the arms in such position. The device is simple and inexpensive, and when made in small size for a garment clasp, the locking may be effected by one hand.

INKSTAND. — George W. Galbreath, Sedalia, Mo. This is a fountain inkstand, in which an apertured cap secured to the body carries a hollow flexible ball with top and bottom apertures, the lower one registering with the aperture in the cap, a tube being carried by the ball, the tube being attached at its upper apertured portion and extending at its lower end downward within the body of the stand. The moment a portion of the attachment is pressed downward the ink flows upward to meet the pen, so that the ink is presented to the pen only when needed, the ink ordinarily remaining in the body of the stand, where it is protected from dust, etc.

POLICE NIPPERS.—Samuel A. French, New York City. The body of the nippers is made in the usual way, and consists of two pivotally connected members, each embracing a handle of essentially L shape, and a curved arm integral with the handle, but the construction is such that the nippers may be conveniently manipulated by one hand, and so that the moment the lock latch or lever is released the arms of the nippers will automatically assume an open position. The action of the lock latch or lever is also more easy and certain than heretofore, and its construction and location such that when the nippers are carried in the pocket they will not present sharp edges to tear the clothes.

AGING WHISKY. — John H. Halligan, Huntsville, Texas. This invention provides an apparatus designed to affect whisky in a very short time in much the manner that it is affected by allowing it to lie in barrels for a term of years. The apparatus consists of a cylinder, the lower part of which forms a heating chamber, while suspended in its upper part is a whisky holding tank, the arrangement being such that the whisky may be unequally heated to give it a slow rotary motion within its tank. It is designed in practice, by thirty days' treatment with the apparatus, to give whisky the apparent age of from eight to ten years.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention and date of this paper.

NEW BOOKS AND PUBLICATIONS.

THE OPTICS OF PHOTOGRAPHY AND PHOTOGRAPHIC LENSES. By J. Traill Taylor. London: Whittaker & Co.; New York: Macmillan & Co. 1892. Pp. viii, 244. Price $1.

This little work should be designated as both practical and timely. It is practical because it covers the ground of the construction, relative good and bad qualities, manipulation and testing of lenses. Mounts and cells, the grinding of lenses and special cases are also treated. It is timely because in these days a photographer should know something about the tools of his trade and should not be satified to merely make the exposures. He should know something of what this book teaches.

MONEY, SILVER AND FINANCE. By J. Howard Cowperthwait. London and New York: G. P. Putnam's Sons. 1892. Pp. v, 242. Price $1.25.

The author of this book is opposed to the free coinage of silver. In his preface he speaks of "the ludicrous spectacle of thousands of men devoting their time and labor to the taking of silver out of the mines, where it could do no harm, for the purpose of placing it in the Treasury's vaults, whence its monstrous bulk menaces the industries and the general prosperity of the country." Such a writer has evidently the courage of his conviction, and such a quality is a commendation of his book.

ELECTRIC LIGHT CABLES AND THE DISTRIBUTION OF ELECTRICITY. By Stuart A. Russell, with 107 illustrations. London: Whittaker & Co. and George Bell & Sons. 1892. Pp. xi, 319. 107 illustrations. Price $2.25.

This accession to "The Specialist's Series" is worthy of a warm welcome. It is a book written, not for the meeting of the requirements of some English "exam.," but for the working engineer. The thoroughly practical nature of the work is evidenced by its topics, such as different methods of cable construction, economical current density in conductors, series, multiple arc, three-wire and five-wire distribution, and many others. Underground lines and systems receive very full consideration, American and English examples being liberally drawn upon. Calculations are employed throughout the work, but the mathematics are kept well within range of the general practical engineer.

THE ELECTRIC RAILWAY IN THEORY AND PRACTICE. By Oscar T. Crosby and Louis Bell Ph.D. New York: The W. J. Johnston Co. 1892. Pp. 400. Price $2.50.

With nearly 150 illustrations this book is a very good contribution to one of the most important branches of electrical engineering. What the railroad of the future will be, and what part electricity will play in its development is altogether conjectural. This book tells what the aspect of the subject is to-day. The subjects of prime motors, electric motors, and car equipments, the line track and station economy, storage battery traction, high speed service, and commercial considerations are typical subjects. In the five appendices considerable useful information is given, notably a section on lightning protection, by Professor Elihu Thomson.

MICHAEL FARADAY, MAN OF SCIENCE. By Walter Jerrold. New York and Chicago: Fleming H. Revell Co. (No date.) Pp. 160. Illustrated. Price 75 cents.

The story of Faraday's life, fascinating in its details of his inauspicious start in life, and of his later work, which stamped his as one of the greatest minds that England ever produced, is given in graphic and popular form in this little volume. The tale is an inspiring one. The illustrations of places connected with the philosopher's life give the book additional value and interest.

THE TANNINS. By Henry Trimble, Ph. M. Vol. I. Philadelphia: J. B. Lippincott Co. Pp. 168. Price $2.

This is a monograph on the history, preparation, properties, methods of estimation, and uses of the vegetable astringents, with an index to the literature of the subject. The latter cannot fail to be especially valuable to any one proposing to conduct experiments in this line, as it appears there has been quite a library published in regard to the tannins. The kind of information which the tanners are looking for, however, that which will enable them to readily determine the absolute and relative tanning values of different tanning materials—seems to be but little nearer their reach than it was brought by the experiments of Sir Humphry Davy in 1803. It is not yet certain but that there are as many kinds of tannin as there are of tanning materials.

ESSENTIALS OF PHYSICS ARRANGED IN THE FORM OF QUESTIONS AND ANSWERS. By Fred. J. Brockway, M.D. Philadelphia: W. B. Saunders. 1892. Pp. 330. Price $1.

This "quiz compend" purports to give the essentials of physics for medical students. It is always an open question what the essentials are. In the case of this book we feel that we award it much praise in stating that we believe most medical practitioners satisfy their consciences with a far more meager allowance of physics than we have here presented. It would prove, we believe, a useful manual for teacher's use in other than medical schools.

A MANUAL OF MINING. By M. C. Ihlseng, C.E., M.E., Ph.D. New York: John Wiley & Sons. 1892. Pp. x, 428. Illustrated. Price $4.

This work is a treatise on mining engineering from the aspect of an American. In this sense it is specially valuable. The works on this and kindred subjects have hitherto been to some extent hampered by tradition. The preparatory work, methods, extraction of ore, application of electricity and water power, pumping, ventilation and many other heads might be quoted in addition to show the exhaustive way in which the topic is

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treated. A list of authorities quoted, and of "manufacturers represented in the illustrations" (meaning, we presume, manufacturers' machines and appliances, as we see no portraits) are commendable features. A peculiarly full index closes the work.

ELECTRICITY AND ITS USES. By J. Munro. London: The Religious Tract Society. Fleming H. Revell Company, New York and Chicago, sole agents. 1890. Pp. xv, 208. Price $1.40.

The oft-trod ground of popular description of electrical appliances is traversed in this attractive volume. Its neat shape and numerous illustrations make it a contribution of some value, although in so crowded a field.

PRACTICAL DIRECTIONS FOR ARMATURE AND FIELD MAGNET WINDING. By Edward Trevert. Lynn, Mass.: Bubier Publishing Co. 1892. Pp. 113. Illustrated. Price $1.50. No index.

This book is of interest now when so many amateur electricians are experimenting with motors. The directions for winding, while not going very deeply into the subjects of sizes for given power, etc., are clear and simple, and so expressed as to be understood easily. The last portion of the work, a little less than one half, is devoted to an outline of the principles of commercial motors and dynamos, and contains a few useful tables.

PRACTICAL CENTERING. By Owen B. Maginnis. New York: William T. Comstock. 1891. Pp. 80. Illustrated. Price $1.50. No index.

The hand of the practical builder and constructor appears in the pages of this book. The thoroughly practical cast of its text and the many useful hints scattered through it make it useful reading for all who are engaged in the class of engineering work of which it treats. The concluding chapters on house carpentry are excellently conceived and put before the reader.

The Shoe and Leather Reporter Annual for 1892 is a volume of nearly 750 pages. The main portion of the book is a directory of the boot and shoe manufacturers, tanners, dealers in leather and findings, hides, furs, etc., and manchinery manufacturers, in the United States and Canada, with names of prominent firms in other parts of the world. It also has particulars as to the organization of a number of trade bodies in different cities, and various other matters of interest in the shoe and leather trades. Published by the *Shoe and Leather Reporter*, New York.

SCIENTIFIC AMERICAN

BUILDING EDITION.

MARCH NUMBER.—(No. 77.)

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Notes & Queries

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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(4116) F. E. H. asks (1) Is there any way to oxidize nickel? A. To oxidize nickel give it a thin coating of silver and oxidize with sodium sulphide solution, or try dipping the nickel into a solution of mercurous nitrate and then treating with sodium sulphate solution. 2. How is etching done on souvenir spoons? A. For silver etching we refer you to the SCIENTIFIC AMERICAN, No. 15, vol. 65, query 3445.

(4117) P. B. W. asks: 1. Will you publish how to cure a cigarette habit? I have been a slave to it for the last 5 years. A. Quit the dirty habit at once and forever. 2. What is good to take the pain out of my breast that the nicotine has made? A. Stop smoking. 3. Is there a substance that you can put in your tobacco that will kill the nicotine? A. No.

(4118) W. R. B. asks: 1. What size wire should I use for a telegraph relay magnet? A. Use No. 32 or 34. 2. Of what sized iron should I make my iron core? A. ⅜ inch diameter and 1¼ inch long. 3. How long and thick should the wire coils on the relay cores be? A. The length of the core and 1⅛ inch outside diameter. 4. Please state some way of softening cores? A. Heat them to a cherry red and bury them in ashes overnight. 5. What kind of iron should I use? A. The softest wrought iron. 6. What size wire and coils should I use on my sounder to work on short circuit, on a circuit of two or three miles? A. No. 24 for local and No. 32 for line. 7. If I made the parts of my instrument of iron, would it be better to temper the iron or leave it soft, to give the best sound? A. If you use iron, leave it soft. For all parts except the magnet cores, yoke and armature, brass is preferable to iron.

(4119) T. C. S. writes: 1. What chemical could I put into a glass and let dry and in a little while, by pouring water or some other chemical into glass, turn it (the water or chemical) black or any different color? A. For black add a little nut galls and iron sulphate, both in powder. For blue use ferridcyanide of potassium in place of the nut galls. Excellent effects may be produced with aniline colors in very small quantity. 2. Would a 40 ohm telegraph sounder work with two batteries on a line of ten or fifteen feet? If not how could I remedy it? A. Yes; but it should have more battery. 3. How do you make the solution of a gravity battery? A. Use pure water, and drop the crystals of copper sulphate into the bottom. A few teaspoonfuls of salt or of sodium sulphate may be dissolved in water and added to start the battery.

(4120) J. M. writes: I desire to learn of some absorbent that can be used in connection with the storage of certain perishable products, such as eggs. I want to find something that will absorb gases and odors, without giving off any odor itself. You are aware, no doubt, that in machine storage, it seems necessary to keep rooms tight, and consequently any gases given off are confined in the rooms. It is this I want to get rid of, as it seems to affect the articles of the more delicate kind of perishable merchandise. A. We would suggest the use of a strong solution of potassium permanganate exposed in shallow vessels. Bone charcoal would also have a good effect.

(4121) J. B. says: 1. He has been trying aristotype paper, and succeeds well except when mounting. After printing and toning I throw the prints into cold water and wash in several waters for two or three hours. I use starch paste new made, but perfectly cold and thick enough to be stiff when cold. I take the print from the water and lay face down on glass and put blotting paper on it, and that takes away all water. I then brush paste over the print carefully, taking care to cover every part of it. I then lay the print on the mount and squeeze it down perfectly flat. I generally wipe off with wet white cloth. I often use a handkerchief, wringing it as dry as possible before using. It is now all right to all appearance. If I place them between blotters to dry, the paper makes them woolly, for it sticks to the blotting paper. If I lay them out on a table to dry, they get along all right till they get pretty dry, then the corners begin to turn up, and sometimes the sides leave the mount too. The man I buy my paper from says to treat the paper as albumen paper. I have tried it every way, and I have lots of trouble with it, and am a little doubtful about it. Please send me a good formula for toning aristo paper, also directions for mounting and burnishing. A. A better mounting paste than starch for aristotype prints is:

Nelson's No. 1 photo. gelatine	4 ozs.
Water	16 ozs.
Glycerine	1 oz.
Alcohol	5 ozs.

Dissolve the gelatine in warm water, then add the glycerine, and lastly the alcohol. This is said to prevent cockling. Alum should be used in the toning and fixing solution to harden the surface. A combined toning and fixing solution is made up as follows:

1. Hypo	10 ozs.
Add water to make	36 ozs.

When dissolved add 4 ozs. of powdered alum.

2. A. Sulphocyanide of ammonia, c. p.	1 oz.
Dissolved in water	2 ozs.
B. Dry chloride of gold, c. p	15 grains.
Chloride of ammonia	60 grains.
Dissolve in water	2 ozs.

Add B to A in small portions, shaking after each addition till the precipitate formed is redissolved, then filter. This solution should be clear and colorless and be kept in a yellow bottle.

3. Nitrate of lead	90 grains.
Water	2 ozs.

Different tones can be made by various combinations of the three solutions.

Warm tones.	No. 1	8 ozs.
	No. 2	2 ozs.
	No. 3	2 drachms.
	Water	6 ozs.
Purple tones.	No. 1	8 ozs.
	No. 2	3 ozs.
	No. 3	4 drachms.
	Water	5 ozs.
Cold tones.	No. 1	8 ozs.
	No. 2	4 ozs.
	No. 3	4 drachms.
	Water	4 ozs.

The bulk of the solution may be lessened by using one-half or one-quarter the proportions above stated. After the prints are dry, and before burnishing, rub the following lubricator over the surface:

Cetaceum (spermaceti)	10 grammes.
Castile soap	10 grammes.
Alcohol	1 kilogramme.

This will give a good gloss. 2. Are the roller burnishers ahead of the other kind? A. They are considered superior. 3. The other day I sensitized some albumen paper with nitrate of silver, and after printing and toning I found it all covered with little blisters about the size of a pin head; at least they seemed to me to be blisters. The paper looked like pebbled leather. Was it my fault or the fault of the paper? A. Blisters generally occur when the solutions are of uneven temperature. All solutions should be between 70° and 80° F. Make the fixing bath one ounce of hypo. to eight of water, and to each gallon of this add two ounces of alcohol and two drachms of ammonia 0·880°. This is said to prevent blisters.

(4122) Young Electrician asks: 1. What number of the SUPPLEMENT contains the construction of the electroplating outfit? A. See SUPPLEMENT, No. 310. 2. What becomes of the energy that is employed in splashing water in a churn? A. It is dissipated in the form of heat. 3. How are storage batteries constructed, and how many cells would it take to light eight 16 candle power lamps through an evening, the plates in the cells to be 10 in. by 8 in. by ⅛ in.? A. Consult SUPPLEMENT, Nos. 322, 677, 685, 342, 426, 455. It will require 11 cells for 20 volt lamps.

(4123) H. S., A. L. S., and others ask how to restore a meerschaum pipe which has been burnt. A. Place corks in both the bowl and stem hole of the pipe, and place for one minute in boiling milk, if the pipe is to be slowly colored and hard, and for the same length of time in boiling beeswax, if the pipe is to be colored quickly.

(4124) G. D. C. asks: 1. Can the simple electric motor described on page 498, "Experimental Science," be run by the gravity battery? If so, how many cells would it require to run the motor at 500 revolutions per minute? If the gravity battery will not run the motor, how many cells of Dr. Gassner's dry battery will it take to run the motor, or will it run it at all? A. Neither the gravity nor the dry battery is suitable for running the simple motor. The motor has very low resistance and requires a battery of low resistance. 2. If the motor be connected up as a dynamo, or as the motor should be and run at about 500 or 1,000 revolutions per minute by foot power, would it give a current of electricity which could be felt by any one, without an induction coil? A. The motor does not act well as a dynamo. It generates only a very slight current. For a dynamo, wind the armature and field magnet with finer wire and use soft cast iron in the field magnets.

(4125) Tel. writes: I am making telescope as described in "Experimental Science." I have an acromatic objective glass 2½ in. diameter, 44 in. focus. The other glasses are eye lens, ¾ in. focus, field lens 2 in. focus. Should I have tube 40 in. long? I had already made the tube before I got glasses, and it is 32 in. long. Will that do as well? A. The 32 in. tube will answer. You can make out the length of the tube by means of a draw tube.

(4126) M. D. writes: 1. I am making the motor described in SUPPLEMENT, No. 641, and would like to know if the core of the armature could be made of a coil of sheet iron instead of the wire? Would it give as good results? A. Sheet iron will not answer as well as wire. 2. Would this same armature do for other motors with field magnets of solid iron instead of Russia iron? A. Yes. 3. How many cells of storage battery would it require to run this motor, and how many gravity cells will be required to charge the storage battery? A. Two cells of storage battery. The gravity battery is not suitable for running the motor, but will answer for charging the storage battery. 4. What is the least number of volts required to run this motor? A. Four. 5. What size dynamo would this motor run? About how many lamps would the dynamo light, each about ten candle power? A. A very small one. So small in fact, that it would not be of much account practically. It is poor policy to run a dynamo by an electric motor driven by batteries. Better make use of the battery current, which is much greater than you could produce in the manner suggested. You might possibly run one or two lamps of smallest size. 6. Would this motor run a 16 ft. canvas boat? How could the speed be regulated? A. Yes; slowly. You would hardly need a speed regulator. The regulation, however, can be effected by introducing more or less resistance in the circuit. 7. Could this motor be made more powerful by increasing dimensions? A. Yes; but we do not advise basing the calculations for a larger motor on the dimensions and proportions of this. 8. In what number of SCIENTIFIC AMERICAN SUPPLEMENT would I find a description for simple dynamo? A. Nos. 161 and 600. 9. How could the battery be fixed to keep it from splashing out by the movements of a boat? A The battery may be provided with a close fitting cover having a small vent tube.

(4127) H. M. T. asks: Can you give instructions for making a Ruhmkorff coil? A. Consult SUPPLEMENT, No. 160.

(4128) W. A. H. writes: 1. I have a glazed earthenware vessel, the right size for a porous cup, but know of no way to take off the enamel. Could you suggest one? A. The glaze cannot be removed. Better purchase your porous cells. They cost very little. 2. I have a single fluid four-cell battery, each cell consisting of a number of electric light carbons with a leaden ring cast around one end and a rod of zinc, well amalgamated in the middle; inside is solution of salt and water. After being worked through a door bell a few days the current diminishes, but the difficulty is removed by cleaning the zincs. Even then the current does not exceed two and one-half volts. A film seems to come over the zincs. Could you tell me of any way to get more current without so much trouble? Have tried sal-ammoniac, but the current does not increase. Is the zinc surface too small? A. Convert you battery into a Fuller battery by placing the zinc in a porous cell having mercury in the bottom, into which the zinc dips. Place bichromate solution outside the cell and water inside. The carbons will, of course, be immersed in the bichromate solution. A current is measured by amperes, not by volts, hence your characterization of your current is meaningless.

(4129) H. A. A. asks: 1. Why is the induction coil described in "Experimental Science" wound as two coils? A. To prevent the passage of sparks from one end of the coil to the other. 2. I want to make an induction coil about 4 inches long by 2 inches in diameter; will a ½ inch core be large enough? A. The core will do. 3. How much and what size wire will I require? A. Use two layers of No. 18 in the primary, and fill the spool with No. 36. 4. I saw a core made inside of a brass tube, and to decrease the current the tube and core were both pulled out. Was this right or should not the core be stationary? A. It is right to have both the brass tube and the core movable. The brass tube may be omitted if the core is movable. 5. How can I splice some pieces of No. 26 wire together to use on an induction coil? A. Twist it together neatly and solder with soft solder, taking care to wash off all traces of soldering fluid to prevent corrosion. 6. Is there a SUPPLEMENT through which I can get some hints on making an induction coil like the above? A. None that gives other information than that contained in "Experimental Science." 7. Please make the following from "Experimental Science," page 550, clearer. A piece of quite thin brass should be bent together in a U form, and the wire should be allowed to pass through the channel thus formed. A. The U shaped piece of metal is designed as a guide. It rests on the coil while the winding progresses and the thickness of the metal determines the space between the convolutions.

(4130) J. J. O'D. asks: How to work Mushett steel to the best advantage, and how to temper it. A. Work Mushett steel in the same manner, and with the same care, as high tool steel. Must not be heated beyond a full red. Requires no tempering. When the tool is finished under the hammer, lay it down to cool. Sharpen as other tools on the grindstone or wet emery wheel.

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(4131) E. N. H. writes: I intend making a motor like the one described in "Experimental Science" on pages 497-509 reducing it one-half. I am going to have castings made for the field magnet and the armature. Could not the armature be cast with wedge like projections to facilitate the winding? A. Cast iron should not be used for the core of the armature. 2. What size wire should the field magnet and the armature be wound with? (In making it ½ size.) A. It depends upon the source of the current and the E. M. F. Probably No. 22 or No. 24 would answer for a battery current. 3. Should I put the same number of layers and convolutions as in making it full size? A. Yes. 4. If it is not a good plan to have the armature cast, could I not cut out some pieces of the shape described from Russia iron? A. Yes.

(4132) S. M. S. says: Can you give me a formula for sensitizing albumen paper that does not need fuming with ammonia? One of my friends can make a sensitizing bath that works nice, do not need to fume the paper. A, Try this:

Water	1 oz.
Nitrate of silver	40 grs.
Nitrate of ammonia	30 grs.
Liquid ammonia	3 min.

Float the paper for 3 minutes. The hydrometer should register from 54 to 56. Very important to keep bath alkaline.

(4133) X. Y. Z. says: I have a negative from which I have been making silver prints, and the silver from the paper has got on to the negative, on account of dampness, I expect, and spoiled it for printing. Can you tell me of any method of removing it? A. If the negative is varnished, remove the latter by soaking in alcohol for a few minutes, then apply the following to the stained part:

A. Sulpho cyanide of ammonia	½ dram.
Water	1 oz.
B. Nitric acid	½ dram.
Water	1 oz.

Mix A and B and apply. A fresh solution should be made for each negative. Follow by washing and applying a saturated solution of chrome alum.

(4134) W. H. W. asks: 1. What would be the result if a motor or dynamo were constructed the same in every respect, that is in the "Experimental Science," Fig. 485, with the exception of the armature core, or in other words, if the wire of the armature were wound on a wooden core (the shaft being also wood) and everything else being the same as in Fig. 485? How much current would such a machine give, run as a dynamo, and how much current would it take as a motor to run it? A. The result of the construction described by you would be to produce a very slight current when used as a dynamo, and as a motor it would possibly rotate itself, but it would not be a success. 2. What would be the result if I wound the armature and put all the wire on the outside of the core, made as directions, winding back and forth over pins in the sides of the core, bringing all the wire of the section on one side? A. The result would be a machine incapable of being used either as a motor or a dynamo, as the currents in the different portions of the winding would counteract each other.

(4135) D. P. sends us diagrams showing two halos concentric with the sun and four sun dogs or parhelia on a horizontal line with the sun at the intersection with the halos, and asks explanation. Both halos are surmounted by inverted colored halos tangent to each of the white halos. The phenomena is attributed to the existence in the upper atmosphere, in the region of the cirrus clouds, of snowflakes thinly dispersed through the air, which reflect and refract the light of the sun at certain angles. As the snowflakes are crystallized in a great variety of forms, the reflections and refractions from their surfaces and through their angular forms seem to account for all the known variation in halos, coronas, sun dogs or parhelia and prismatic colors of the inverted halos.

(4136) E. L. says: Noticing your directions for coloring photos, in SCIENTIFIC AMERICAN of February 20, 1892, page 119, I beg to ask: 1. Will not the solution render the oil colors soft and flow over the other part of the paper when rubbed with the finger? A. We think not, since the color is first thoroughly dried. 2. Are the effects permanent, and for how long? A. Probably for several years.

(4137) T. W. K. asks for the ingredients that compose luminous paint, to make numbers that can be seen in the dark. A. Barium and calcium sulphides formed by ignition are characteristic ingredients. See our SUPPLEMENT, Nos. 229, 197, 249, 539.

(4138) G. A. L. says: Please let me know through your paper what direction the north star is from the north pole? A. The pole star is now about 1¼° from the true pole. When the middle one of the three stars in the handle of the dipper (Mizar) is on the meridian below the pole star, the true pole is 1¼° below the pole star. In any position of the line between the two stars the true pole is 1¼° from the north star toward Mizar.

(4139) C. E. D. asks how to find the altitude of a triangle when the base and the sum of the altitude and the hypotenuse is given. A. Altitude = sum of altitude and hypotenuse squared *minus* base squared, the whole divided by twice the sum of hypotenuse and altitude.

(4140) W. W. asks: 1. How can I explode a cannon with electric battery? Will you please let me know how to proceed, what kind of battery to use, etc.? A. You can explode the charge in a cannon by means of an electric fuse having a small platinum wire surrounded by fine powder. A current from a Grenet battery heats the wire to redness, and explodes the powder, the latter igniting the charge of powder in the cannon. 2. Is cast iron preferable to soft iron for the field magnet of a dynamo? A. No; soft iron is preferable. 3. Which is right? A says that if an article like tooth powder or face powder is put up and sold, that its sale can be stopped by law if it is not patented, while B says, if it is beneficial and harmless, its sale cannot be stopped and that a patent is only to protect it? A. Taking out a patent does not oblige the patentee to sell, nor does the mere fact that a patent is not taken out prevent selling an article unless it infringes an existing patent. 4. Also what is the meaning when they say such an article (face powder, etc.) is liable to stamp? A. It probably refers to the internal revenue stamp. The appliction of a stamp to articles of merchandise is not now required on articles of the class named.

(4141) J. F. L., Jr., asks: 1. What is a 10 per cent solution? I have been told the following:

1. 1 oz. solid substance (480 gr.).10 fl. oz. water.
2. 6 grs. " " ..... 1 " " "
3. 6 grs. " " .....54 grs. " dist.

A. A solution containing one-tenth its weight of the substance dissolved. This corresponds with your third formula. The second is altogether wrong. 2. How may I put up a formula as follows:

Dextrin	2 parts.
Acetic acid	1 "
Water	5 "
Alcohol	1 "

A. Weigh all parts. 3. Can you me a formula for the fastest developer you know of for fast gelatino-bromide dry plates?

A. Eikonogen	1 oz.
Sodium sulphite C. P.	2 "
Warm water	30 "
When cool add	
Carbonate of potash	½ "

If this develops too slowly add more carbonate of potash. 4. Can you tell me briefly how to form artificial crystals of alum, copperas, salt, sugar, etc., on a thread for crystallographic purposes? A. Simply make a strong solution and while hot immerse the threads. After crystallization place more solution in the vessel. Always let it cool a little before adding.

(4142) A. M. asks for the name of the acid used for stencil work on glass plates and how to use it? A. Hydrofluoric acid is used in etching glass. It can be purchased from wholesale druggists in New York prepared for use, or you can prepare it yourself by pouring sulphuric acid upon fluorspar. A lead dish is required for this operation. The glass is protected with wax, paraffine or varnish. Where lines are required the protecting coating is removed with a needle or scraper. The glass is placed over the lead dish and the hydrofluoric fumes rising from the dish attack the glass where it is exposed. Care must be taken to not inhale these fumes and to avoid getting the acid on the skin, as it is very corrosive and poisonous.

(4143) P. T. L. asks: What volume and fall of water will it require to furnish power to maintain 68 arc lights 2,000 candle power and 5,000 incandescent lights 16 candle power? What will first cost be in comparison with a steam plant of say 600 horse power? Will cost of maintenance be less? Is there less danger of stoppages? What is the life of a turbine working 16 hours per day? A. Your installation will require about 600 horse power actual from the water power motor. If a turbine of good make is used, the waterfall should be equal to 700 horse power, as this depends upon two elements viz., height of fall and quantity of flow. We must necessarily refer you to SCIENTIFIC AMERICAN SUPPLEMENT, No. 788, for illustrated description of the method of measuring a water power. The first cost of a turbine and head flume is much less than a steam plant, and in favorable places the dam and complete power plant may be brought within the cost of a steam plant. The economy of running expenses depends upon the cost of coal, but is no doubt much less than steam. With any degree of care against floods there is little or no danger of delays, far less than with the dynamos. Turbines run for many years without interruption.

(4144) E. W. H. says: I have a long fence with 4½ inches by 4½ inches Oregon fir posts set 3 feet in the ground. Fence has only been in position one year, yet the portion of the posts in the ground show considerable rot on the surface when dug down on. The posts were green when set. I do not want to take up the post, yet, at present rate, it would appear that they would rot off in three or four years. Would it do any good to bore into the posts, just above the ground, in a standing direction, and fill the holes with some mineral salt? If so, how large should the holes be and what should they be charged with? A. We do know that the plan proposed will fully preserve the posts, but will no doubt add several years to their life. Soaking the ends of posts in a strong solution of sulphate of iron or sulphate of copper for a day has been tried and found efficient for several times the life of posts without any application of preservative. We think it will pay to bore a ⅝ hole in as slanting a position as convenient, from 4 inches above ground, say at 45°, three-fourths through the post, and fill it with a saturated solution of sulphate of iron. In a few weeks again fill the holes and plug with wood or a cork.

(4145) W. W. M. asks: 1. Can you give a description in the SCIENTIFIC AMERICAN of the ginseng of Washington, Oregon, and Idaho, where found, and illustrate if you can? A. We refer you for articles on ginseng in general to the SCIENTIFIC AMERICAN, vol. 65, p. 104, vol. 64, pp. 19, 69, 309. 2. I send specimen of ash of burned flax. Can you explain what gives the color, etc.? A. The colors are due undoubtedly to the presence of iron, and possibly some carbonaceous matter.

(4146) J. K. M. — For the information you require regarding brazing and japanning, we refer you to "Scientific American Cyclopedia of Receipts, Notes and Queries, price by mail $5.

(4147) C. M. T. asks: 1. Have you a good book on induction coils? If so, what price? A. SUPPLEMENT, Nos. 160, 166, 229, and 569, also Dyer's "Induction Coil," 50 cents. 2. How many electric light carbons will it take to give E.M.F. of one volt? (About 5 inches of carbon in fluid.) How much zinc? A. One carbon and one rod of zinc of any size will give an E.M.F of nearly two volts. 3. I have a telegraph sounder that seems to have residual magnetism in the cores to such an extent that it affects the free movement of the armature. Is there any way to remove the magnetism? A. Remove the magnet cores, heat them red hot and bury them in ashes overnight, or until cool.

(4148) R. P. asks: Why do the English believe the occasional finding of a horseshoe to be a good omen? A. There is no reasonable explanation of the horseshoe superstition. There is no scientific connection between the finding of a horseshoe and good luck, excepting possibly the fact that one who picks up a horseshoe or anything else of slight value and saves or makes use of it is apt to have good luck. Possibly some of our readers may be able to give the origin of this peculiar notion.

(4149) C. H. B. writes: 1. I have been contemplating trying to use water glass as a substitute for glue in sizing spirits of turpentine barrels. I have been informed that it can be used for this. A. We think it would answer your purposes. 2. How is it prepared and used? A. It is made by dissolving silica in caustic soda solution under pressure. Apply with a stiff brush.

(4150) A. T. M. — The word "typewriter" does not indicate either sex, and is correctly applied to both; "typewritist" is an offensive eccentricity. "Cosmopolitan" is correctly used as a noun, and more frequently than "cosmopolite," though there is no objection to the latter if you prefer it. The word "macadamized" is usually employed as an adjective, accent on second syllable.

(4151) J. V. D. asks: Would a five horse power electric motor (500 volts, 10 amperes) afford sufficient power to drive a 10 in. circular saw for cutting cordwood? A. Five horse power would be ample for driving a 10 in. cross cut saw.

TO INVENTORS.

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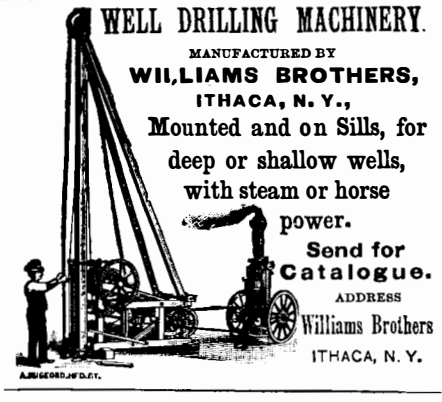

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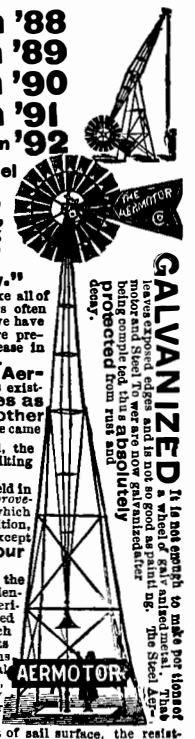

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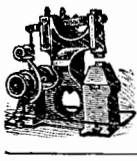
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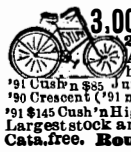
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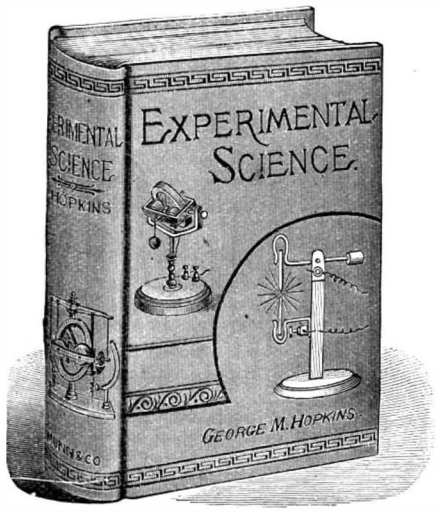

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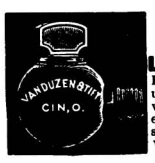

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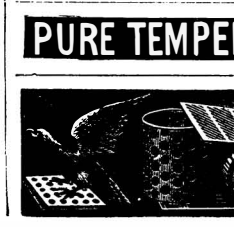

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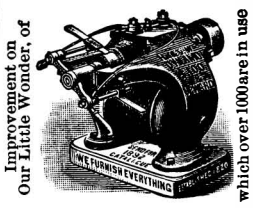

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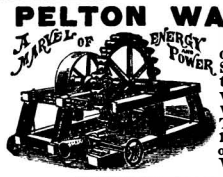

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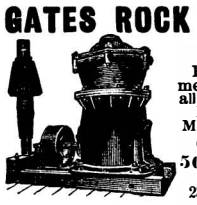

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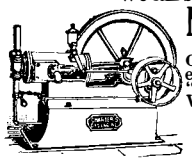

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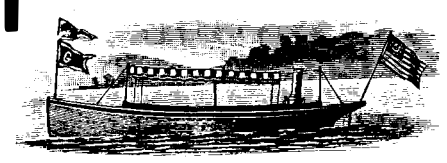

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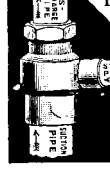

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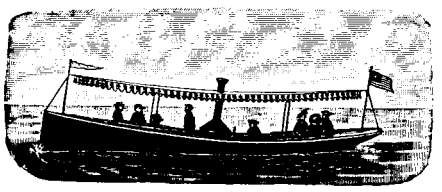

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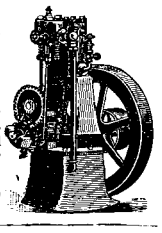

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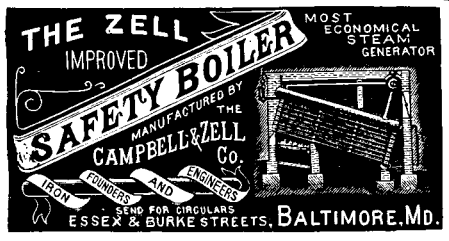

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